Plan Change 14 to the Waipā District Plan – Mangaone Precinct

Integrated Transportation Assessment

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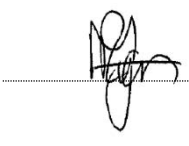
Melissa Ryan  09/05/2024

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Abbreviations

Abbreviations	Full Name
AADT	Annual Average Daily Traffic Volume
BIL	Bardowie Investment Limited
CAS	Crash Analysis System
District Plan	Waipā District Plan
HCV	Heavy Commercial Vehicle
ITA	Integrated Transportation Assessment
km/h	kilometres per hour
LTP	Long Term Plan 2021-31
LOS	Level of Service
ONF	One Network Framework
PPC	Proposed Plan Change
PT	Public Transport
RAMM	Road Assessment and Maintenance Management
ROW	Right of Way
RPS	Regional Policy Statement
RPTP	Waikato Regional Public Transport Plan
RR453	Research Report 453 “Trips and Parking Related to Land Use”
SH	State Highway
vpd	vehicles per day
vph	vehicles per hour
Waka Kotahi	Waka Kotahi NZ Transport Agency
WDC	Waipā District Council
WEX	Waikato Expressway
WRC	Waikato Regional Council

1 Introduction

The key elements of this Plan Change 14 to the Waipā District Council – Mangaone together with a summarised overall assessment is set out as follows.

1.1 The Proposal

The proposal seeks to re-zone land located within the C10 Industrial Growth Cell in Hautapu (at 185 and 195 Swayne Road, Cambridge) from Rural to Industrial through a proposed Plan Change 14 to the Waipā District Plan – Mangaone Precinct (referred to as Plan Change 14 or PC14). PC14 also seeks to embed a new Structure Plan for the site that is subject to the rezoning proposal into the Waipā District Plan (the District Plan).

The proposed zoning and Structure Plan will enable development of the approximately 79.2 ha. Most of this land comprises Fonterra Limited's (Fonterra) Bardowie Farms which is currently used for farming and dairy factory wastewater irrigation. The remaining land is located at 137 Swayne Road owned by Bardowie Investment Ltd (BIL) to the south and adjoins the Waikato Expressway (WEX) for industrial activities. While the BIL portion is included within the zoning, it is understood that a separate resource consent is being advanced for this land parcel. Rezoning will bring this parcel into alignment with the surrounding land areas.

Development of the rezoned site is anticipated to occur in stages over the medium to long term, subject to market conditions and resource consent processes. Similarly, transport infrastructure is planned to be stage developed, aligned with demand and provisioned for through specific intervention and within the Long- Term Plan 2021-2031 (LTP) in relation to strategic infrastructure needs.

1.2 Key Transport Matters

This Integrated Transportation Assessment (ITA) has been prepared to support the proposed rezoning and Structure Plan. It assesses the transportation elements of the zoning proposal and outlines the recommended transport infrastructure improvement works required to support it.

The scope of the ITA includes description, analysis and evaluation pertaining to the following:

- The existing transportation environment;
- The site location and surrounding land uses;
- The transport network structure of the proposal;
- Site access and transport infrastructure needs;
- Walking, cycling and public transport infrastructure; and the
- Transport policy and rule settings required to support the Structure Plan.

1.3 Plan Change and Structure Plan Transport Assessment Conclusion

The proposed land use zoning intends to liven up of the land for industrial purposes as has been signalled by Waipā District Council (WDC) through its Growth Cell identification. To enable this the Structure Plan identifies the need for a range of staged infrastructure.

This transport assessment has considered the potential full and long-term development planning for the area. This includes the potential for development of land yet to be brought forward through a Plan Change and Structure Plan. Based on these considerations, the potential transport effects for the full Hautapu Growth Cell area have been assessed as making full use of the transport network capacity ultimately to be established.

By way of an overall assessment, it is concluded that PC14 and the Structure Plan can be accommodated with the supporting transport infrastructure and associated staging provisions recommended.

2 Strategic Transport Planning Context

A summary of the key guiding strategic planning documents is set out in **Appendix A**. By way of an overall summary, the following key observations can be made:

- The C10 Growth Cell is an identified and planned growth area for Cambridge;
- In planning for growth, the strategic guidance places an emphasis on:
    - Maintaining and enhancing efficient use of the transport networks;
    - Increasing density when compared with existing urban form;
    - Integrating new development areas with the existing urban environment;
    - Providing for safe, multi-modal transport outcomes to minimise reliance of motor-vehicles and single occupant vehicle-based travel; and
    - Provide for future public transport servicing to be integrated with development when that is planned.

Some of the key, locally specific, strategy and policy context is summarised as follows:

2.1 Future Proof Strategy 2022

The Future Proof Strategy 2022 (Future Proof Strategy) was most recently updated in 2022 to provide strategic direction and influence changes to the Regional Policy Statement and District Plans. Key elements of the Strategy are summarised as follows:

- The Future Proof Strategy identifies key growth areas as including the Cambridge/ Hautapu areas. [1]
- Hautapu is identified in a strategic public transport network schematic diagram (refer to Figure 2-1)[2],as a local node to be serviced at 10-15 minutes intervals as part of the "*Frequent Network*".
- The proposed urban form is described as comprising of ongoing growth and development of areas / townships including Hautapu.[3]
- While not identified as part of the metropolitan economic corridor, areas such as Hamilton Airport and the Hautapu Industrial area are described in the Strategy as "*also playing an important role*" in terms of economic activity in the sub-region. [4]
- The Hautapu Industrial area is identified as one of the several "*Strategic Industrial Nodes*" within the Future Proof sub-region. [5] Approximately 227 ha of industrial land is allocated for the Hautapu node, to be released in a staged manner. The Future Proof Strategy anticipated an initial release of approximately 67 ha (between 2020 and 2030) and then a further 160 ha post 2030. "Area 6" was recently accepted and included into Future Proof Strategy after it was considered through a

[1] Future Proof Strategy 2022, page 6
[2] Future Proof Strategy 2022, Map 4: *Metro Public Transport Schematics*, page 56
[3] Future Proof Strategy 2022, page 63
[4] Future Proof Strategy 2022, page 71
[5] Future Proof Strategy 2022, page 73, Table 2

submission made and is identified in the 2022 Future Proof Strategy as "*short term development*" for industrial activities.

- The Future Proof Strategy has set minimum residential density targets within urban enablement areas, which includes the Cambridge/ Hautapu areas, and identified the Cambridge/ Hautapu area as being serviced by "Frequent" 10-15 minutes interval public transport service in the future. [6]
- Key actions identified to implement the Future Proof Strategy are described as including the development of a programme business case that will consider supporting and enabling rail and road infrastructure in key growth areas including Cambridge West – Hautapu amongst other areas.[7]

Future Proof 2024-54 has recently (February 2024) been consulted on as a draft document. Hearings are set down for late March 2024. A review of the draft documents indicates the following:

- Hautapu remains a key growth area;
- Transformational Move 5 identifies Hautapu as a key employment area;
- The key purpose of the land use continues to be identified as Industrial; and
- The public transport servicing for the area is described as "Frequent"[8].

It is evident the 2024-54 draft strategy signals a continued focus on the Hautapu area as a key Industrial employment area.

[6] Future Proof Strategy 2022, page 96
[7] Future Proof Strategy 2022, page 105
[8] Draft Future Proof Strategy 2024-54, Part C, Table 9

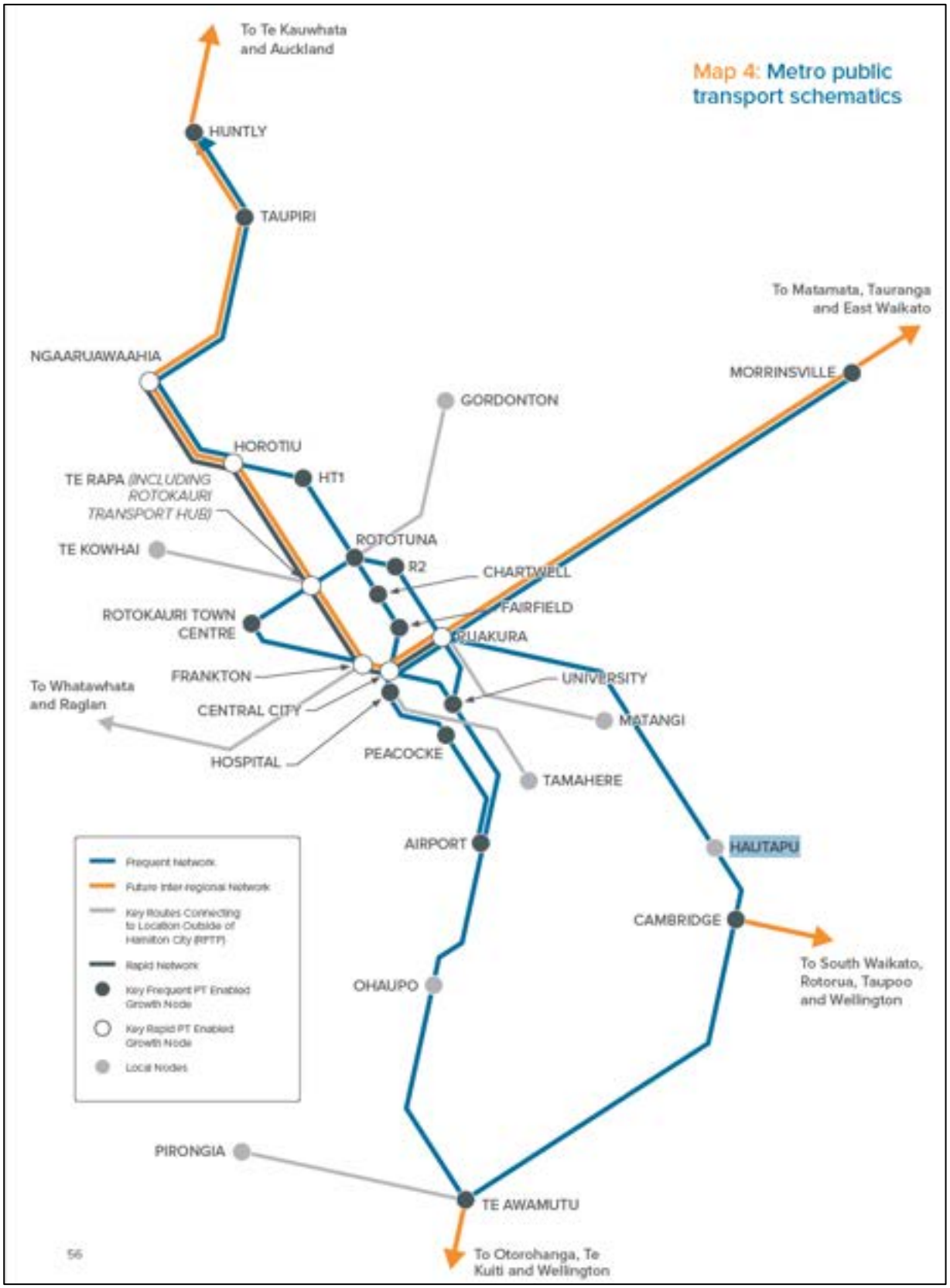

Figure 2-1: Future Proof Strategy 2022 – Map 4: Metro Public Transport Schematic

2.2 Waikato Regional Policy Statement (Aug 2022)

The Waikato Regional Policy Statement (RPS) is intended to communicate outcomes from the higher order Resource Management Act 1991, National Policy Statements and Environmental Standards and Strategies, through to Regional and District Plans.

The Future Proof Strategy's industrial land allocations are described in the RPS as including the Hautapu Industrial Node based on the land specified in the Waipā 2050 Growth Strategy and the Future Proof Strategy 2022.

2.3 Waikato Regional Public Transport Plan 2022-2032

The Waikato Regional Public Transport Plan 2022-2023 (RPTP) is a strategic document that sets the objectives, aspirations, and policies for public transport in the region over the next 30 years and provides a concept for regional public transport connectivity for the 10-year period between 2022 and 2032. The overall goal set out in this plan is as follows:

"Enable a better Waikato by enhancing people's lives and shaping the future with outstanding transport solutions."

While there isn't specific reference in the RPTP to public transport linkages to the Hautapu Industrial area / node at this time, the establishment of frequent public transport links between Hamilton and larger metro towns inclusive of Cambridge township has been identified as a key action.[9] Cambridge township is located within easy walking and cycling distance to the industrial area, with walking and cycling linkages already provided and/or proposed.

2.4 Waipā District Walking and Cycling Strategy (2008)

The Waipā District Walking and Cycling Strategy (2008) continues to provide some direction for walking and cycling outcomes. Key points of reference include:

- The corridor between Cambridge and Hautapu is identified as providing opportunities for off-road cycle paths along the district's cycle routes;[10]
- The Hautapu area has been identified as an area for growth of industrial activity and is therefore suitably located in terms of the Hautapu Industrial employment area, north of the WEX;[11] and
- Trips to work by bicycle in Hautapu were identified as contributing a further 5.7% of all such trips in the Waipā District in 2008.[12]

[9] RPTP 2022-2023, page 19
[10] Waipā District Walking and Cycling Strategy 2008, Pg 18
[11] Waipā District Walking and Cycling Strategy 2008, Page 38
[12] Waipā District Walking and Cycling Strategy 2008, Page 41

2.5 Waipā DC Transport Strategy 2022-2052

The Waipā Transport Strategy 2022-2052 sets out the direction for the district's transport system over the next 30 years. The vision of the strategy is:

"*People and freight in Waipā have access to an integrated, safe, sustainable transport system that provides a range of travel choices. People are at the centre of our solutions."*

A concept plan for the rapid transit vision for transport in the Hamilton-Waikato Metro Spatial Plan is illustrated in Figure 2-2 below.

As shown in the figure, Hautapu is identified as a local node serviced by a "Frequent Network" at 10-15 minutes intervals. The neighbouring Cambridge is identified as a "Key Frequent PT Enabled Growth Node". The strategy aligns with the transport strategy in the Future Proof Strategy 2022.

It is evident that the future growth planning anticipates the C10 Growth Cell and requires it to be planned in a way that ensures it is appropriately integrated with the existing and planned urban environment. The extent to which this is planned through PC14 is described and assessed in the sections that follow.

Figure 2-2: A rapid vision for transport in the Hamilton-Waikato Metro Spatial Plan (source: 2022-2025 WDC Transport Strategy)

3 Current Transport Environment

The key aspects of the current transport environment are described as follows.

3.1 Existing Transport Network Characteristics

Further to and commensurate with the above descriptions, key elements of the local transport network pertinent to transport context for the proposal can be summarised as follows:

3.1.1 Waipā DC Road Hierarchy

The currently established road hierarchy for the key local roads are summarised as follows:

- Victoria Road – WEX to Hautapu Road: major arterial (SH1B);
- Victoria Road: Hautapu Road to Zig Zag Road: major arterial (SH1B);
- Victoria Road: North of Zig Zag Road: major arterial (SH1B);
- Zig Zag Road: Victoria to Swayne Road: local road;
- Swayne Road: Zig Zag Road to WEX: collector road; and
- Laurent Road: local road.

The road hierarchy indicates an important arterial status for Victoria Road / SH1B. WDC has advised it is currently engaging with Waka Kotahi NZ Transport Agency (Waka Kotahi) and expect to see this section of SH1B revoked, with the road falling under the control of WDC within to 2023/24 period. The status and impact of this on the road hierarchy setting is not yet known, however it is expected to continue to provide a strategic local access function together with its current wider distributive function in the coming years.

It is also apparent that Swayne Road is identified as a collector road performing an important local collector/distributor function north-south and linking the rural community to the north with the more local and urban Cambridge environment.

The remaining roads are assessed as local roads, performing a predominant access function.

3.1.2 One Network Road Hierarchy

Figure 3-1 shows the Waka Kotahi One Network Road Hierarchy for the area. It can be seen the roads surrounding the site are primarily assessed as performing a collector/distributor function. Laurent Road is identified as a local road delivering a primary access focussed outcome.

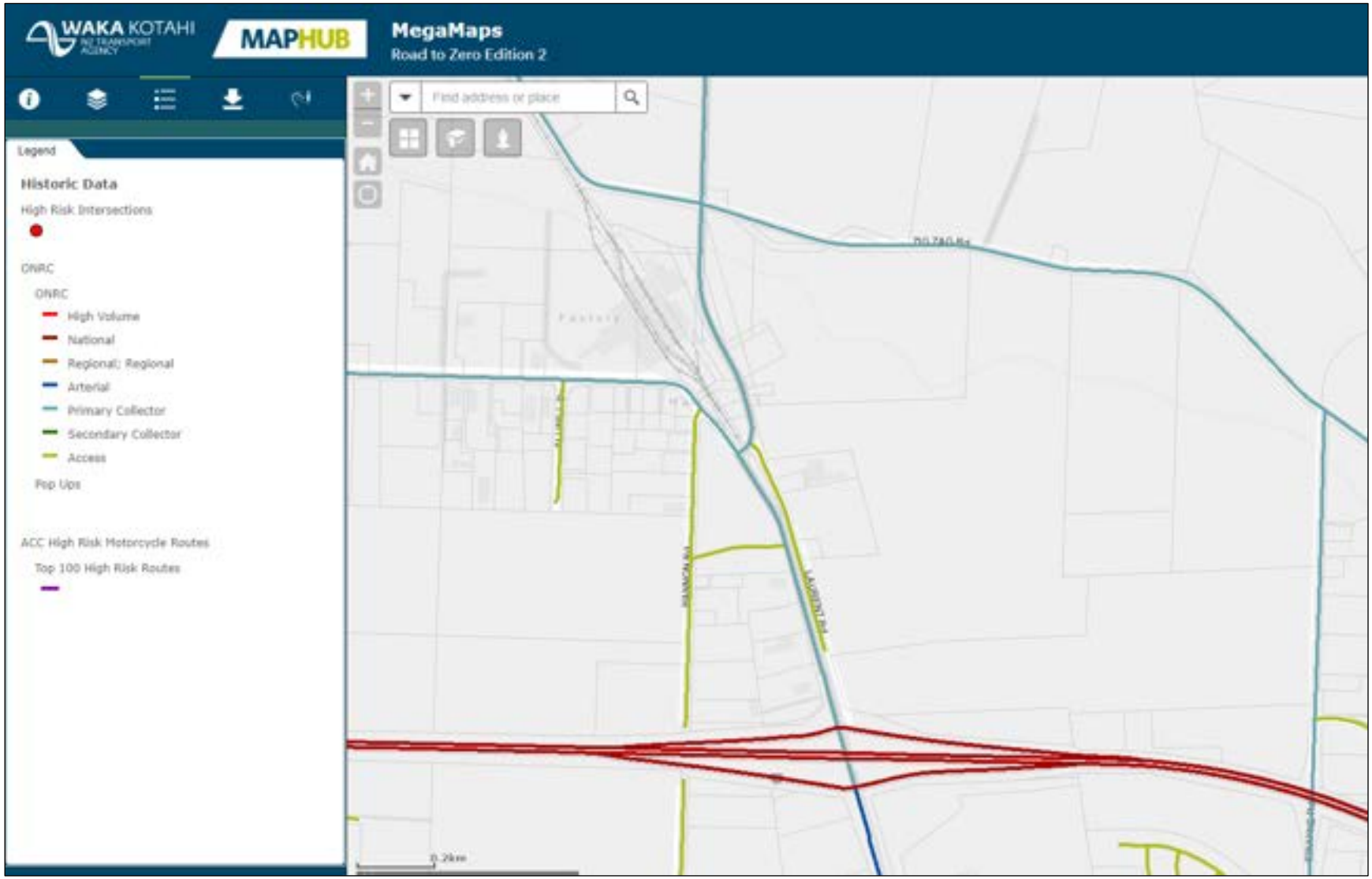

Figure 3-1: Waka Kotahi Mega Maps One Network Road Hierarchy

The functions identified for these District roads are generally aligned and consistent with the functional intent described in the District Plan.

3.1.3 Cambridge Walking and Cycling Plan

The Waipā District Cycling & Walking Strategy (2008) establishes the strategic structural form intended for the district's cycling and walking networks. The key linkages for the local area are shown on the following Figure 3-2.

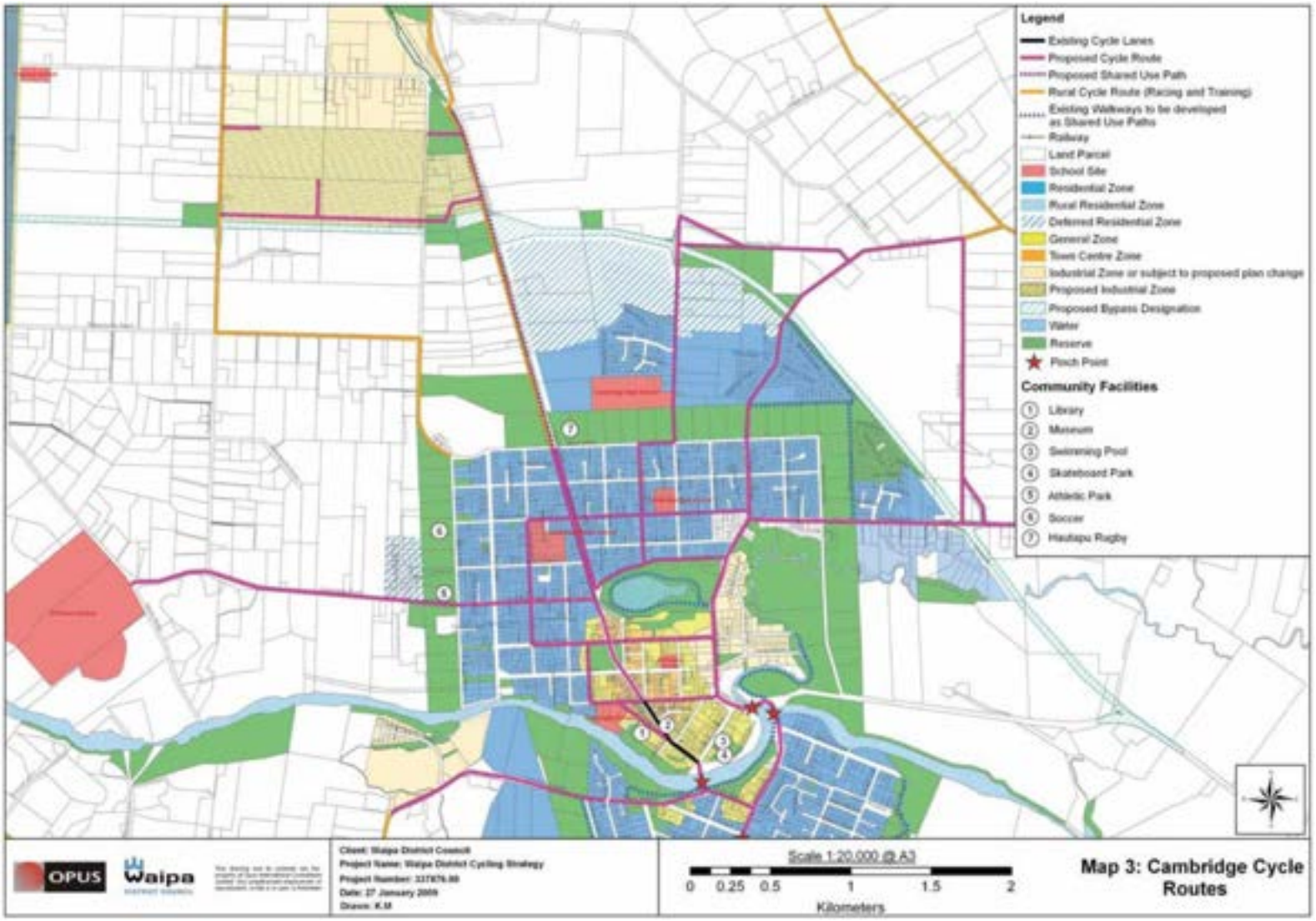

Figure 3-2: WDC Cycle Routes Map for Cambridge (Source: Waipā Cycling & Walking Strategy (2008))

Key elements for cycling in the area are planned as follows:

- Victoria Road, WEX to Hautapu Road: is shown as a Rural Cycle Route and as providing for a shared use path;
- Victoria Road north of Hautapu Road: Rural Cycle Route;
- Swayne Road: south of Appleby Road; and
- Appleby Road: East of Swayne Road.

The recently determined Plan Change 17 Hautapu Industrial Structure Plan extends the multi-modal network into the C8 and C9 Growth Cell areas and also extends the Victoria Road shared path west along Hautapu Road to Peake Road.

No elements are shown on Zig Zag Road or for Swayne Road north of Appleby Road. Nonetheless, it remains important that the land use areas are well connected in terms of walking and cycling modes. The extent to which this is planned to be provided for is described in the following sections.

To further inform the current movement environment accessibility, isochrone mapping has been prepared. The following Figures show 30-minute accessible isochrones for walking and cycling (in 5 minute intervals), based on the three points of access from the current road network to the Structure Plan area. A 30 minute interval has been selected to align with the Future Proof 30 minute neighbourhoods objectives.

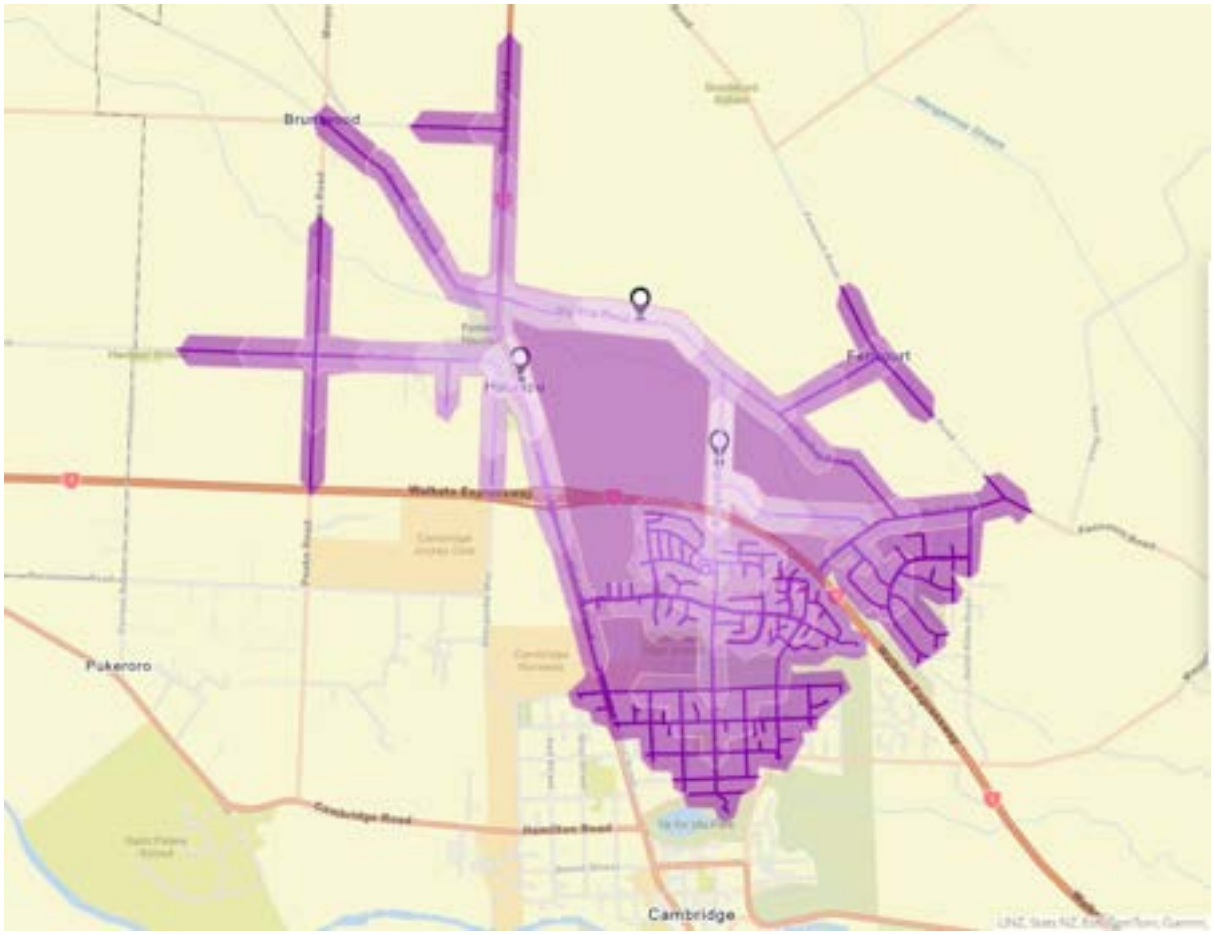

Figure 3-3: 30 Minute Walking Isochrone Map

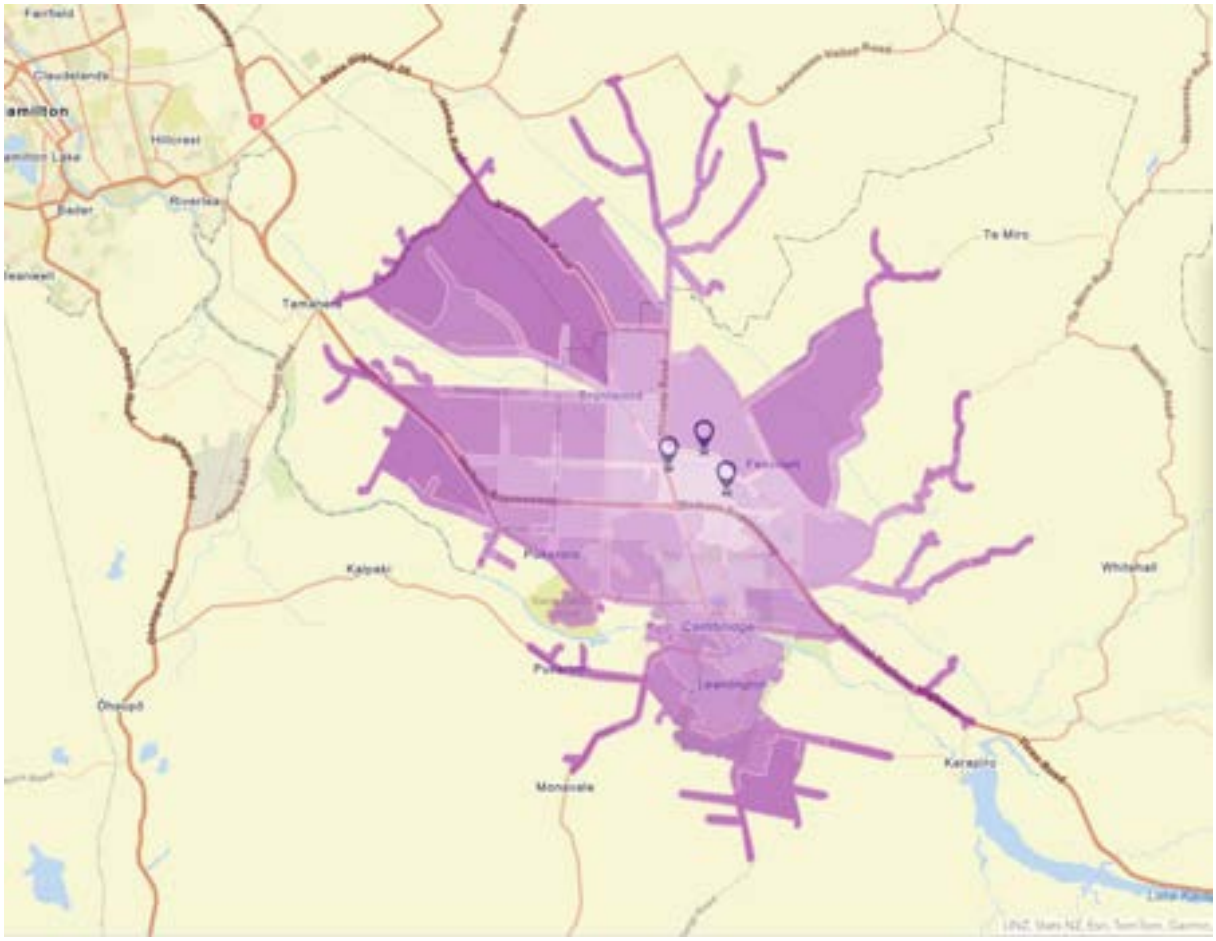

Figure 3-4: 30 Minute Cycling Isochrone Map

The key metrics that can be observed in the figures are as follows.

For walking, the site is accessible to the following extents:

- North of the Victoria Road / Wiseman Road intersection;
- West on Hautapu Road past Peake Road and almost to the Hautapu school;
- South to about Lake Te Koo Utu and the Reserve; and
- East to Fencourt Road.

For cycling, the site is accessible to the following extents:

- North on Victoria Road to Scotsman Valley Road;
- West to a point just short of the Tamahere interchange on the Waikato Expressway;
- Southwest incorporating all of the Hamilton – Cambridge Road and including St Peters School;
- South incorporating all of the Cambridge and Leamington town centre and surrounding urban living environments;
- East to well beyond Fencourt Road and into the rural environment; and
- The southeastern extent indicates that the Karapiro Dam would be accessible by about a 35-minute cycle.

Overall, it can be summarised that most of the urban living environment north of the Te Koo Utu Reserve and east of Victoria Road is accessible within a 30-minute walk and all of the Cambridge and Leamington urban living environments are serviceable by a 30-minute cycle.

3.1.4 Current Traffic Speed Environment

The currently established speed limit environment is shown on Mobile Road on the following Figures.

Victoria Road (between the WEX and Hautapu Road), Zig Zag Road, and Swayne Roads are all posted as 80km/h speed environments. A reduced speed limit applies to Victoria Road north of Hautapu Road to Zig Zag Road, at 70km/h. This recognises the higher access function and activity established through this area together with some sections being of a more constrained carriageway width.

The southern part of Swayne Road, south of Appleby transitions to a 50km/h urban environment and is supported by speed management devices and the speed change gateway at the location.

It is anticipated that some speed settings for the environment will need to adjust as development progresses in the area. This is a regular review function undertaken by WDC and is able to be provided for within the normal review cycles.

The following Figure 3-6 indicates the mean operating speed environment assessed by Waka Kotahi. It is evident by comparison of this with the speed limit settings that the operational environment is on average, about 5 to 10 km/h below the speed limit. Notwithstanding this, and while that indicates most of the traffic movement function operates within the speed limit, some movements are expected to operate at higher speeds. Safe management of accesses and intersections account for this in their design and sightline requirements.

The Figures above indicate a relatively rural environment at present that is expected to change with development activity. A potential speed environment outcome for this environment is assessed later in this report.

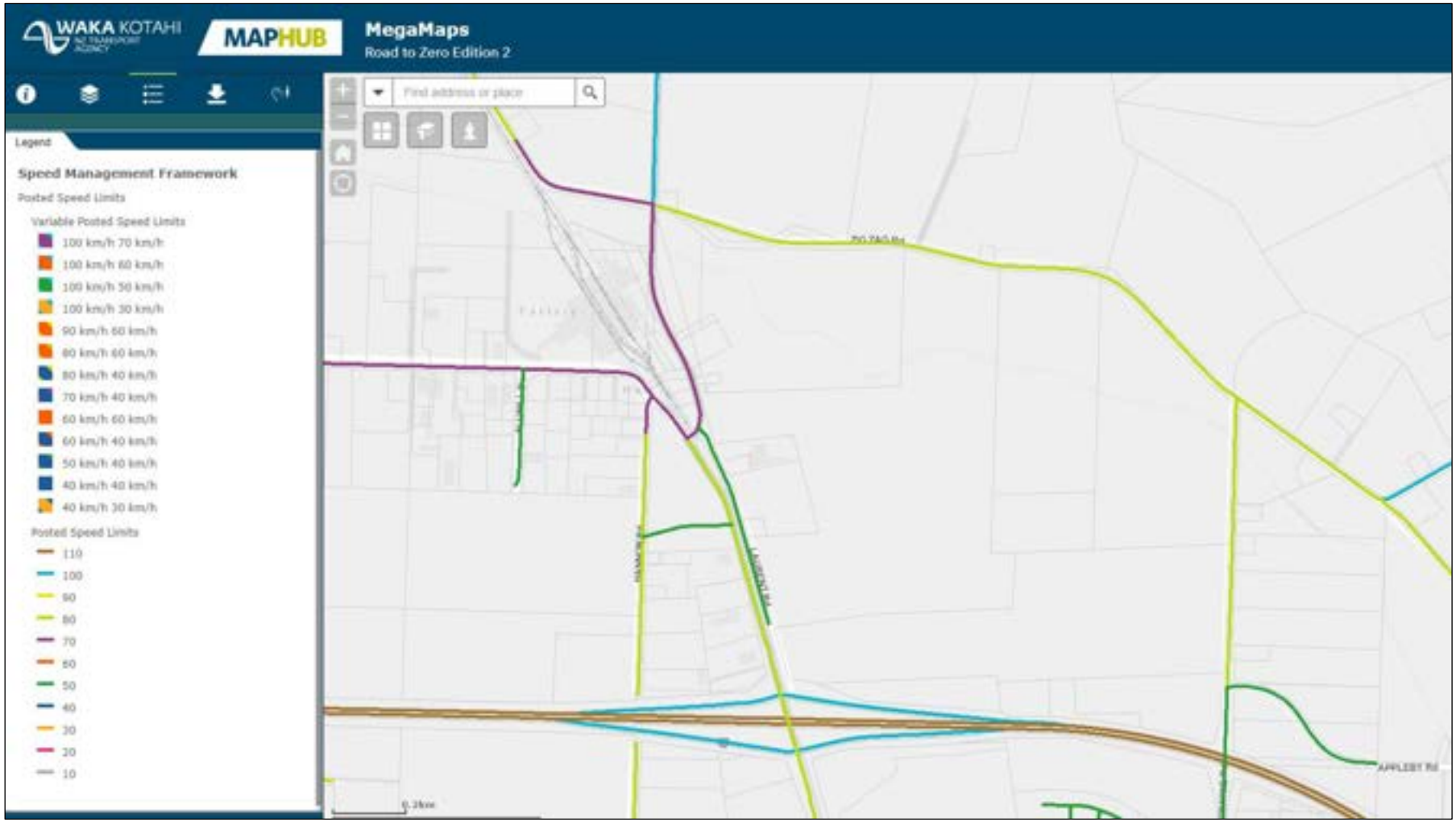

Figure 3-5: Waka Kotahi Mega Maps Posted Speed Limits

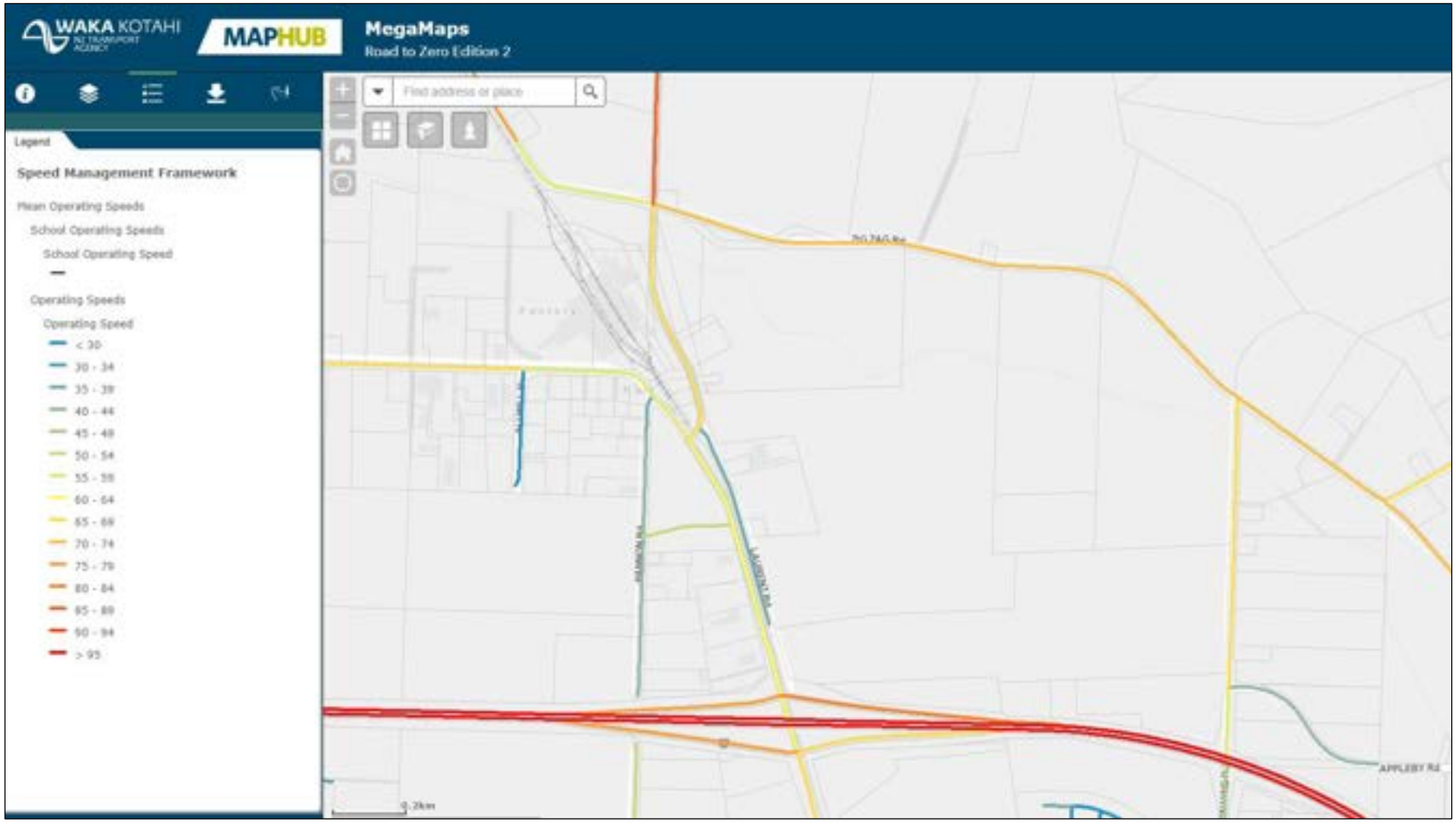

Figure 3-6: Waka Kotahi Mega Maps Mean Operating Speeds

3.1.5 Current Traffic Volume Environment

Current traffic volumes as recorded on Mobile Road for the local roads are as follows:

- WEX East of Peake Road: 11,592 (AADT decreasing), 11,413 (AADT increasing);
- Victoria Road – WEX to Hautapu Road: 10,185vpd (AADT), 9.7% HCV, 12m seal width;
- Victoria Road – Hautapu Road to Zig Zag Road: 8m-11m variable;
- Victoria Road: North of Zig Zag Road: 5,232 (AADT), 10% HCV,
- Zig Zag Road: Victoria to Swayne Road: 2,450vpd (2021), 7% HCV, 6.8m seal width;
- Swayne Road: Zig Zag Road to WEX: 2,171vpd (2023), 10% HCV, 6.1m seal width increasing to 11.4m south of Appleby Road; and
- Laurent Road: 45vpd (2020), 8.9% HCV, 6m seal width.

The following observations can be made in relation to these traffic volumes:

- The WEX expressway is a four-lane divided carriageway with a potential ultimate capacity in the order of up to 40,000vpd. It is therefore operating at just 30% of its potential long-term capacity;
- The Victoria Road arterial is operating at about 25 to 50% of its potential two-lane corridor capacity; and
- The current collector and local road environments are also operating well within their practical operating limits when considered in the context of their intended functions.

The planned transport infrastructure environment will change as a result of the demands generated within the Hautapu area, adding to the underlying transport capacity. The potential impact of this added capacity together with the forecast increased demands is assessed later in this report.

3.2 Committed Transport Infrastructure

The subsections to follow describe committed transportation infrastructure improvement works in the Hautapu area (including the Hautapu Industrial Structure Plan and the adjacent BIP Structure Plan areas).

3.2.1 Committed Transportation Projects by Others

The following are key transportation projects planned by others in the wider Hautapu area:

- A new single-lane roundabout on SH1B - Victoria Road (opposite and south of the Hautapu cemetery) with a new connector road to the BIP. Based on recent conversations with WDC and Waka Kotahi, construction of the new intersection is planned to commence in the coming months. The Gray Matter assessments for BIL indicate an expected future upgrading (double-lane roundabout, or signalisation with dual turning lanes) is need to accommodate the C10 and / or other growth demands.[13]

[13] Gray Matter, Proposed South Intersection Roundabout Victoria Road, Cambridge – Integrated Transport and Roundabout Assessment (Bardowie Investments Limited), Draft2 for Review, 8 October 2019 report

- An additional northern access to the BIP land adjacent to the future Victoria Road/Hautapu Road roundabout. The northern access will form a later stage ("Stage 2") of the Victoria Road/Hautapu Road intersection upgrade (which is indicatively designed as a roundabout). It is indicated as likely coming online prior to the development of Stage 3 of the BIP (this area may not be developed until 2024).
- WDC has allocated $300,000 to a Business Case for the "Cambridge Connections" project which seeks to define the shape of Cambridge's transport infrastructure for the next 30 years and secure government funding to help pay for these.

3.2.2 WDC Long Term Plan 2021-2031

Approximately $86.1M has been allocated to the Hautapu Industrial area (including the C8, C9 and C10 Growth Cells) in the LTP for the 10-year period between 2012 and 2031 to "*unlock future growth*".[14] Of this, approximately $24M has been allocated to transport projects.

Table 3-1 below provides a summary of key transportation projects identified for the Hautapu industrial node, including any details (if available) related to the funding source, timing, and staging provisions.

Table 3-1: LTP 2021-31 - Committed Transportation Projects for the Hautapu Industrial Area

Project No.	Description	Historical Project	Estimated Capital Costs	Funding Source (%)	
				DC Growth	Other
3076	Hautapu – Roading	$1,167,600		85%	15%
3076	Hautapu – Roading	$600,000		100%	0%
3170	Hautapu – Cycleway connection Victoria Road to Hannon Road	$305,940		100%	0%
3192	C8 C9 C10 Hautapu Rd 1st Roundabout at Victoria Rd		$4,149,000	70%	30%
3193	C8 C9 C10 Hautapu Rd – 1st section of Collector Rd		$2,789,100	100%	0%
3194	C8 C9 C10 Hautapu Rd & Hannon Rd Urbanisation		$4,609,200	60%	40%
3195	C8 C9 C10 Hautapu Road – 2nd roundabout at Victoria Rd		$1,688,400	95%	5%
3199	Hautapu Transportation Land		$10,919,416	100%	0%
Total		**$2,073,540**	**$24,155,116**	**-**	**-**

It can be seen that substantive investment is planned to align with anticipated development progress in the area. WDC monitors transport infrastructure needs in the area and manages forward allocations through the LTP process.

[14] Long Term Plan 2021-2031, Page 44

3.2.3 WDC Annual Plan 2022-2023

Hautapu infrastructure growth projects are listed in the WDC's Annual Plan 2022-2023 (Annual Plan) as one of the key undertakings for the 2022/23 financial year, with a budget of approximately $15,427M committed for the financial year.

The budget allocation has increased by $6.4M since the last LTP to ensure infrastructure provision aligns with timing of development. To that effect, the budget for construction of the C10 (BIP) / Victoria Road southern roundabout and a new collector road (Stage 1) has been included in the Annual Plan with construction projected to be completed in 2022/23. These projects are additional to those budgeted in the LTP.

4 Future Transport Environment

4.1 Recent Transportation Assessment Reporting

There has been some significant transport planning, land use rezoning and transport infrastructure planning activity within the local Hautapu area in recent times. Collectively these planned changes now form part of the anticipated future transport environment within which any further transport planning needs to consider.

These earlier reports are summarised in WDC's assessments pertaining to the Plan Change 17 area relating to the C8 and C9 Growth Cells. They remain relevant in defining the current and substantially unformed land use and transport environment. The key summarises for these are included as Appendix B to this report.

Key outcomes from these processes have established the following current transportation planning environment:

- Key intersections servicing the Growth Cell area are well planned in terms of their staged implementation and futureproofing for anticipated development. These in particular refer to the Victoria Road/Hautapu Road and the BIP roundabout controlled intersections;
- The C8 and C9 Growth Cell areas have been comprehensively considered in terms of multi-modal access and future network integration through the recent Plan Change 17 and Structure Plan processes;
- The Victoria Road corridor between the WEX and Hautapu Road has a variable corridor width of between about 17m and 21m. Four traffic lanes inclusive of a 1.5m shoulder area each side can be expected to occupy a 17m cross-sectional width where this is needed long-term. Alternative walking and cycling facilities are currently established outside of this corridor, and within the adjacent rail corridor. The adjoining rail corridor has a width of about 6.0m. If this is able to be utilised long term the combined corridor width would be in the order 23 to 27m and more effectively positioned to support the long-term transport capacity of the wider Hautapu Industrial growth area. The adjacent and easterly Laurent Road corridor has a 17m corridor width and is a strategic road corridor provision that could support the long-term future of Victoria Road where these are able to be established and/or operated coherently; and
- The BIP C10 Growth Cell area adjoining the subject site has also been well considered in terms of multi-modal transport access, movement, and facility, documented through the Industrial Zone provisions of the District Plan and captured in the associated Structure Plan.

The transport planning assessments pertaining to PC14 shall have regard for these future state outcomes and the potential further transport infrastructure responses warranted in relation to the transport demands generated, their distribution and potential effect. Any determined transport infrastructure response is to integrate with the network provisions planned and required through these recent local plan changes.

4.2 Anticipated Land Use Consent Applications

A land use consent application is understood to be being prepared to support a relatively low external impact activity planned for the BIL portion of the southern part of the PC14 proposal. Key elements of that proposal are understood to comprise the following:

- Primary access to be supported by a new and currently under construction roundabout and access on Victoria Road, servicing the wider BIL industrial area, together with the minor and formed local access on Swayne Road; and
- The principal function of the site and activity planned is a maintenance operation to support the activities on the wider BIL site, still to be developed. Therefore, primary activity generated transport; and
- Movements are expected to be internalised to the BIL site and not rely on the external transport network.

The overall transport impact is assessed to be negligible in the context of the combined wider site activities and no further or altered transport infrastructure outcome is expected.

4.3 Identified Future Transport Infrastructure

The following future transport infrastructure works have been identified through adjoining/adjacent Structure Plans in the Hautapu area:

BIP Structure Plan:

- Victoria Road Development Access, indicatively a roundabout, is located opposite the southern edge of the cemetery. The Gray Matter assessments for BIL indicate an expected future upgrading (double-lane roundabout, or signalisation with dual turning lanes) is needed to accommodate the C10 and / or other growth demands;[15]
- Victoria Road/Hautapu Road/Development Access, indicatively a twin roundabout arrangement either side of the rail corridor, future-proofed for dual laning;
- District Plan Rule S20.2.5 Infrastructure, identifies that any development "within the Structure Plan area, a development proposal will need to demonstrate compliance with the Waipā District Plan, including infrastructure provision. The following sections detail how the site is intended to be serviced";
- A range of Design Guidelines are established in support of the Structure Plan to direct outcomes in this area. They include guidance around outcomes for transport infrastructure.

Hautapu Industrial Structure Plan:

- A similar range of design guidelines is established in the Hautapu Structure Plan as are set for the BIP area;
- Hannon Road intersection at Hautapu Road is too close;
- Hautapu Road, Victoria Road to Peake Road to be upgraded including a shared pathway and signals at Allwill Drive;
- Access restrictions to Peake Road as development transitions to frontages within the Structure Plan area; and

[15] Gray Matter, Proposed South Intersection Roundabout Victoria Road, Cambridge – Integrated Transport and Roundabout Assessment (Bardowie Investments Limited), Draft2 for Review, 8 October 2019 report

- A future intersection, indicatively a roundabout at the Victoria Road/Hautapu Road/Hannon Road intersection.

It is evident there is some shared and overlapping accountability for intersection improvement works between the Hautapu Industrial and BIP Structure Plan areas. A similar shared accountability is assessed in respect of PC14. These outcomes are managed and provisioned for by WDC through the LTP process and in terms of development contributions requirements.

5 Road Safety Environment

Key and historic characteristics on the local road environment around the proposed site are described in the following sections.

5.1 Waka Kotahi MapHub Road2Zero Road Safety Indicators

Waka Kotahi MapHub identifies the indicative location and severity of crashes on the local transport network over the most recent and complete 5 years period. These are located and shown on the following Figure 5-1.

Key observations from Figure 5-1 are as follows:

- There is an apparent cluster of crashes, predominantly minor and one serious at or around the Victoria Road / Zig Zag Road intersection;
- A section of Hautapu Road west of Victoria Road has been identified as a high benefit speed management corridor, i.e. by reducing the current speed limit there;
- There is a cluster of crashes around the on and off-ramp intersections on the north side of the WEX interchange. Again, these are predominantly minor with one serious crash indicated; and
- There are intermittent crashes, minor in severity, distributed on Zig Zag Road.

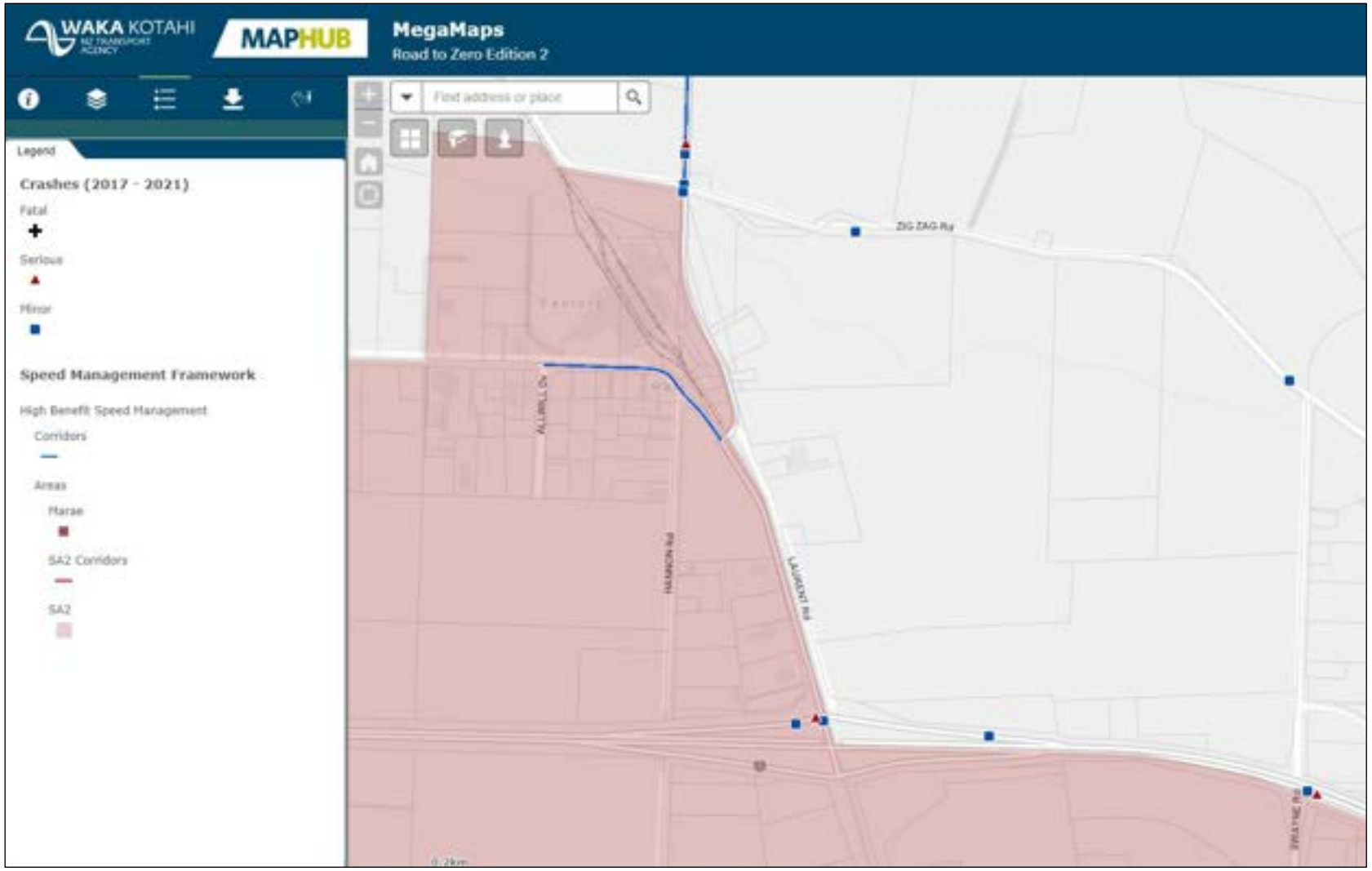

Figure 5-1: Waka Kotahi Mega Maps Road Crash Locations (2017-21)

5.2 2018-2023 Crash Analysis Data

The Waka Kotahi data is dated 2017-2021. More current data is available on the Crash Analysis System (CAS) system including 2022 and some 2023 data, noting that there is a lag in the event occurring and it being recorded. An inquiry of this data has been undertaken with the aggregated results shown on the following Figure 5-2. Further data pertaining to this is contained at **Appendix C** of this report.

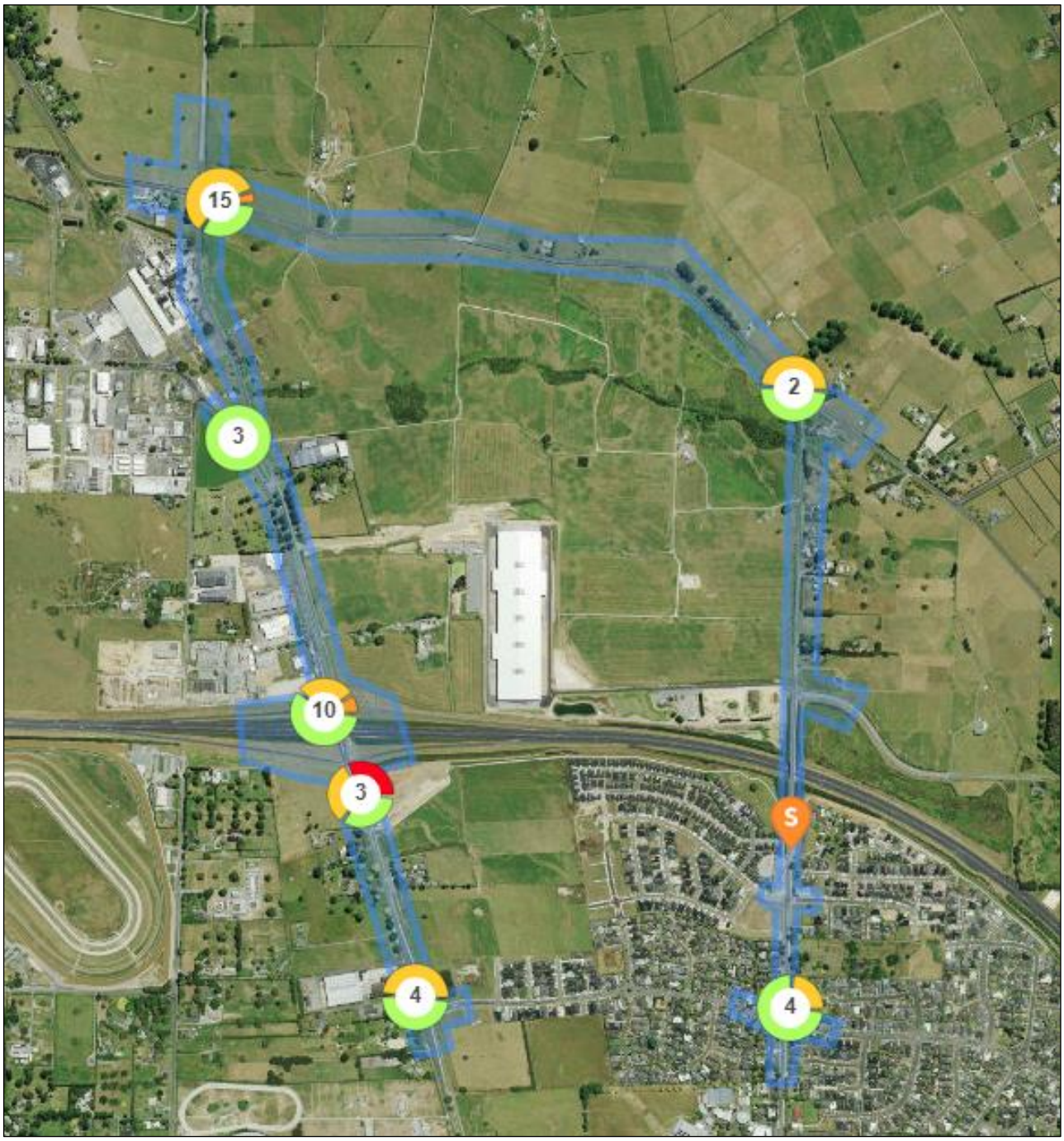

Figure 5-2: 2018-23 CAS Data Summary

Key observations from this data are summarised as follows:

- The data set is somewhat richer than is indicated on the preceding Figure 5-2;
- The Victoria Road/Zig Zag Road intersection and its surrounds is evidently a persistent crash location, these being predominantly minor and non-injury incidents;
- Three crashes have been identified at the Victoria Road/Hautapu Road intersection or in that vicinity. These are all non-injury crashes which is why they have not appeared on the Waka Kotahi mapping above (Figure 5-1);
- The WEX interchange ramp terminal points are evident crash locations. These are predominantly minor and non-injury north of the interchange. Detailed assessment of the data indicates that there have been two crashes at or near the southern ramp terminals. One of these crashes involved a fatality and is indicated as having occurred on Victoria Road about mid-way between the interchange and Norfolk Drive to the south;
- Crashes on Zig Zag Road are shown aggregated to the intersections in the Figures above. Detailed assessment identifies that the crashes are minor or non-injury and are located near the Victoria Road or the Swayne Road intersection. Two non-injury crashes can be identified at the first bend, approximately 300m east of Victoria Road;
- There have been no recorded crashes, including non-injury crashes on Swayne Road.

Overall, the Victoria Road corridor is more predominantly utilised and subject to crash impacts, these crashes being predominantly minor and non-injury. There are no apparent significant serious crashes or significantly adverse crash locations evident. That said, there are evident recurrent crash locations involving minor or non- injury crashes at:

- Victoria Road/Zig Zag Road intersection; and
- In the vicinity of the interchange ramp terminals.

6 Proposed Rezoning and Structure Plan

The following describes the site location and key land use and transport nature of PC14.

6.1 Site Location and Description

PC14 intends Industrial zoning across part of the C10 Growth Cell area shown on Figure 6-1. It can be seen that the establishment of an Industrial zoning over this area is anticipated by the District Plan, Growth Cell definition.

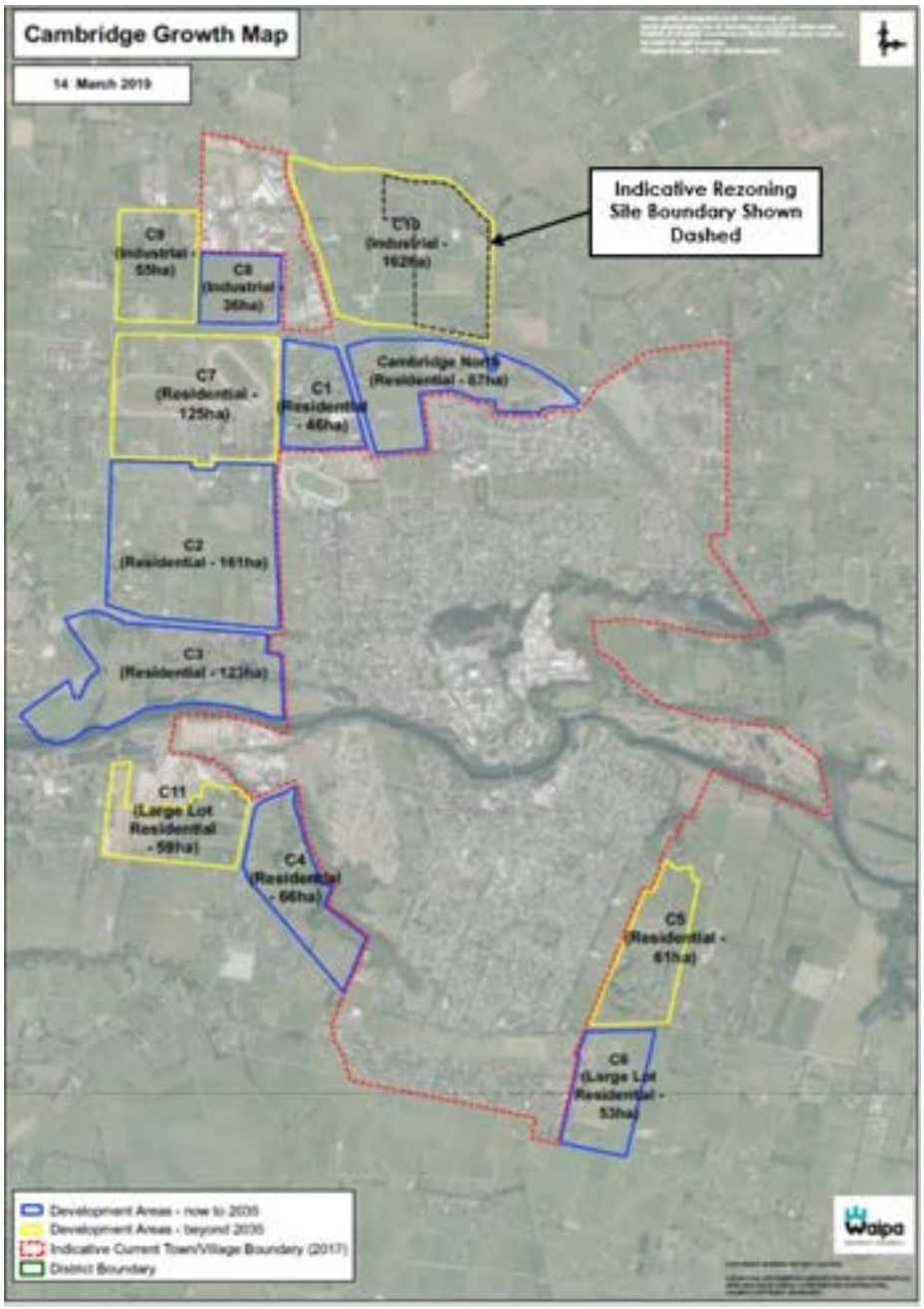

Figure 6-1: Locality Map (source: Waipā District Plan, Appendix S1 – Future Growth Cells)

A parcel known as the BIL land holding occupies the western part of the zone. Plan Change 17 has recently established Industrial zoning status across the C8 and C9 Growth Cell areas. These are indicatively shown on Figure 6-2 as follows.

Figure 6-2: Extent of subject site

The Fonterra owned block and the southern BIL site are shown. The total area is approximately 79.2 ha.

The Mangaone Stream runs generally east-west through the north of the site, bisects the site into two areas as follows:

- The Fonterra area to the north of the stream: approximately 24 ha in size; and
- The Fonterra area to the south of the stream: approximately 47.4 ha in size.

The proposed rezoning is located approximately 1 km east of the Fonterra Hautapu Dairy Factory. The C8 and C9 industrial Growth Cells, which comprise the Hautapu Industrial Structure Plan area (Plan Change 17), are located slightly further west on Hautapu Road and Hannon Road.

The land adjacent to the subject proposal is currently zoned as follows under the District Plan:

- Rural along the northern and southern boundaries of the subject site, on the opposite side of the two frontage roads (Zig Zag Road and Swayne Road respectively);
- Along its western boundary:

- Industrial along the section adjoining the BIL; and
- Rural along the remainder of its western boundary.

- The WEX adjoins the southern boundary of the site.

6.2 Plan Change 14 – Mangaone Precinct Proposal

A Structure Plan has been prepared to describe the land use and infrastructure elements of the proposal. This is shown on the following Figure.

The key land use and transport elements of PC14 can be summarised as follows:

- Industrial land use;
- Local amenity cafe and commercial, limited in size;
- A primary East-West (E-W) collector road from Victoria Road in the west linking across the site towards the east and connecting with the primary internal distributive intersection;
- External road network integration linking with Victoria Road, Zig Zag Road and Swayne Road, location flexible;
- Internal distribution enabled with the BIP land and the Bourke property; and
- A North-South (N-S) connection internalising connectivity between the northern and southern parts of the Fonterra block.

PC14 also proposes the following access and staging arrangements:

- A stage developed intersection form connecting with Victoria Road, responding to traffic demands as they emerge;
- A similar intersection improvement arrangement at Victoria Road/Zig Zag Road/Bruntwood Road;
- A safe intersection point of access onto Zig Zag Road;
- Staged development of the E-W collector road in response to land development patterns and generated traffic demand;
- An access restriction on Victoria Road east, between Zig Zag Road and the Structure Plan collector road, linked with site redevelopment and to ensure safety on the Victoria Road corridor long-term;
- A physical, visual and regulatory restriction to manage access to Swayne Road for light and medium heavy vehicles not exceeding 12 tonnes gross (single unit vehicles); and
- A range of local road improvements corresponding with the anticipated traffic demands to be generated.

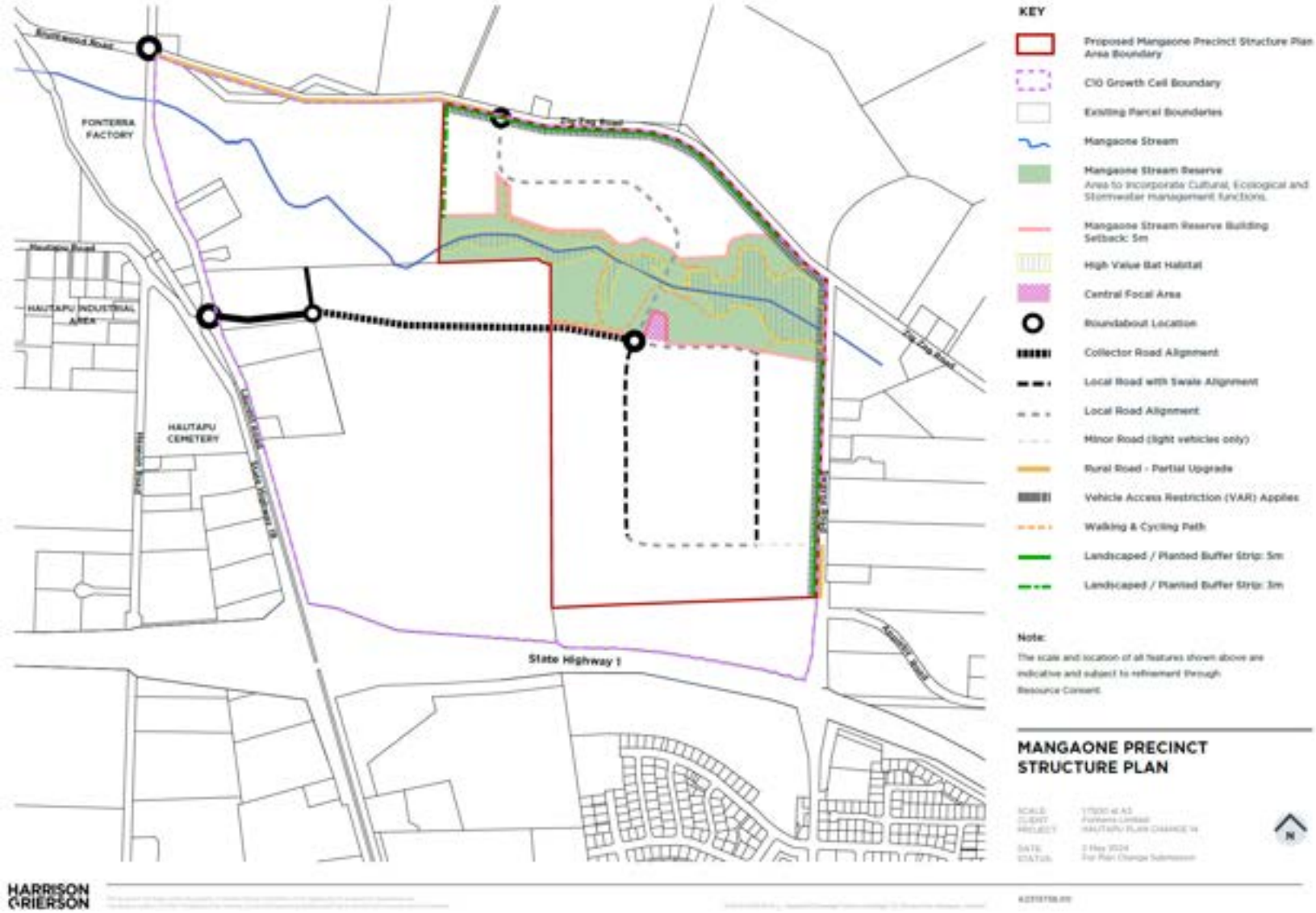

Figure 6-3: Mangaone Precinct Structure Plan

Multi-modal transport facilities are shown connected with existing or planned infrastructure and include:

- Primary cycling and pedestrian facilities to be established:
    - On the western side of Swayne Road from the WEX overbridge to the site access;
    - E-W across the riparian area from Swayne Road, linking north to Zig Zag Road and south to the internal collector road;
- Secondary off-road cycle and pedestrian paths linking with WDC's externally planned primary cycle and pedestrian paths:
    - E-W across the site through the riparian area connecting via the collector road corridor with Victoria Road and to Swayne Road; and
    - Internal distribution connections with the collector road and along the local road corridors.
- Facilities integrated with the internal road corridors are to be established. These are shown on the indicative road cross section diagrams later in the report.

The Urban Designers advise that the pedestrian and cycle routes through the Mangaone Stream reserve are intended as part of the wider strategic network (future), as anticipated by and discussed with Waikato Regional Council. These form part of the overall integrated design approach where cycling is to be separated from the road carriageway where there is expected to be a high proportion of heavy commercial vehicle movements in the traffic mix.

Public transport servicing is a planning matter for the Waikato Regional Council (WRC) and WDC working together. Extensive planning and assessment have already been advanced in this space. Funding for these services will be related with the extent of development and emergence of demand over time. The internal collector road network is planned to enable public transport servicing where that emerges as a need in future. The primary public transport network however is expected to be established on Victoria Road. The Hautapu area has been identified in the RPTP as a key node to be frequently serviced in future.

The timing and need for these measures has been assessed and is described in the assessments that follow.

7 Predicted Travel Demands

The following assessments describe assessment of the trip generation and distribution demands.

7.1 Plan Change Predicted Trip Generation

Trip generation rates have been well established in other assessments within the Hautapu Industrial area. The land use activity type proposed is consistent with that planned for the C8 and C9 Growth Cell areas. The BIP area adopted a similarly consistent approach in its assessments.

The Waka Kotahi RR453 Trips and Parking Related to Land Use guide does not provide guidance pertaining to wider area trip generating demands, but rather focusses on individual site and activity impacts. These will be relevant when individual site applications and assessments are made.

Hamilton City Council District Plan adopts lesser rates pertaining to its recently developed Te Rapa south industrial area, specifying:

- 14.1 trips/hectare/morning peak hour, or
- 15 trips/hectare/afternoon peak hour.

These rates are expected to represent the likely long-term demands. For the purposes of infrastructure evaluation and effects assessment however, a somewhat higher generalised trip rate can be valuable to provide a high degree of confidence in the outcome.

An industrial trip rate of 20 trips per ha in the peak hour (AM and PM) has been adopted for other areas in Hautapu to date. This is assessed as representing an appropriately upper end forecast when considering multiple activities across a wide area. Potentially it is a level 30% higher than the long-run demand arising from development activities and in particular, with larger lot developments the trip rates have the potential to diminish significantly from these levels. Adoption of this higher demand level also potentially results in a cumulative over-estimate of the collective demands expected to be generated, where each separate growth cell adopts a higher conservative trip demand level. Further, and subject to shift change over times there is potential that the 10% peak hour of the transport network assumption is excessively high. With 24-hour operations often shift change times occur prior to or by 7:00am in the morning and are off-set in the afternoon from the road network peak. The potential impact of these reducing cumulative demands is assessed further, later in the assessment.

On these bases, the following generated trip demands have been assessed for PC14:

Table 7-1: Structure Plan Trip Generation Forecast

Structure Plan area	Estimated size (ha)	Peak Hour		Daily	
	- Gross	Trip rate	Trip Gen	Trip rate	Trip Gen
Northern Area	24	20	480	200	4,800
Southern Area	47	20	948	200	9,475
Total	**71**	**20**	**1,428**	**200**	**14,275**

Table 7-2: Structure Plan Trip Arrival-Departure Distribution Forecast

Structure Plan area	Directional Distribution					
	AM Peak		PM Peak		Daily	
	IN	OUT	IN	OUT	IN	OUT
	87%	13%	18%	82%	50%	50%
Northern Area	418	63	87	394	2,400	2,400
Southern Area	825	124	171	777	4,738	4,738
Total	**1,243**	**187**	**258**	**1,171**	**7,138**	**7,138**

The above Tables show the following:

- The normal weekday is expected to result in up to 14,275 trips, two-way in total over a 24 hour period:
- The peak hour (AM and PM) periods are expected to each generate 1,428 two-way trips;
- The AM and PM peak arrival and departure demand profiles are different as shown in Table 7-2.

When the trip distributions are broken down into their respective arrival, departure and distributed point of connection to the transport network it is evident that these are readily manageable at the land use interface with the transport network. The extent to which these cumulatively contribute to the transport network is assessed in the following sections.

7.2 Unzoned Local Trip Generation Demand Potential

The potential additional transport demands expected to be generated by either unzoned or other known local consent processes are assessed and described in the following sections.

7.2.1 Bourke Property Trip Generation

The Bourke Property (23.4ha) is located to the west of the PC14 site. The potential for this site to generate traffic has been assessed for the purpose of confirming the long-term transport network infrastructure needs and to confirm that the works necessary to support PC14 are consistently proposed.

The potential trip generation due to the Bourke Property is summarised in the following Tables:

Table 7-3: Potential Bourke Property Trip Generation

Bourke Property	Estimated size (ha)	Peak Hour		Daily	
	- Gross	Trip rate	Trip Gen	Trip rate	Trip Gen
Bourke Property	23.42	20	468	200	4,684
Total	**23**	**20**	**468**	**200**	**4,684**

Table 7-4: Assessed Bourke Property Distribution

Bourke Property	Directional Distribution					
	AM Peak		PM Peak		Daily	
	IN	OUT	IN	OUT	IN	OUT
	87%	13%	18%	82%	50%	50%
Bourke Property	408	61	85	385	2,342	2,342
Total	**408**	**61**	**85**	**385**	**2,342**	**2,342**

The above Tables show that the potential long term trip generation is expected to be material due to the Bourke Property. Its future connectivity with the road network and internally to integrate with the remainder of the C10 Growth Cell is unknown at this time. Notwithstanding, the assessments that follow have made assumptions as to the distribution and describe the extent that regard has been had for this area.

7.2.2 Bardowie Kiwifruit Block – Swayne Road – Trip Generation

The above Tables show that the potential long term trip generation is expected to be material due to the Bourke Property. Its future connectivity with the road network and internally to integrate with the remainder of the C10 Growth Cell is unknown at this time. Notwithstanding, the assessments that follow have made assumptions as to the distribution and describe the extent that regard has been had for this area.

7.3 Network Trip Distribution Resilience

The capacity for the local transport network has been assessed in the first instance to ensure regard is had for the different phasing of development and the ways it could impact the transport network. The following sections describe these assessments. The outcome from this exercise has informed determination of the anticipated future traffic environment and the consequent transport infrastructure response, addressed later in this report.

7.3.1 Baseline Traffic Demands

A baseline network traffic demand has been assessed for the Hautapu area. This is based on the following underlying assumptions:

- Current known traffic demands on the network, drawn from available and recently reported data;
- Overlaid forecast trip demands due to the recent PC17 for C8 and C9 Growth Cell areas are included together with the demands assessed in respect of the BIP site as consented; and
- Future underlying growth on the transport network determined from the Waikato Regional Transportation Model (WRTM) on the basis of a 2041 horizon year.

Therefore, the baseline traffic environment comprises a substantial component of the build-out for the greater Hautapu Industrial area together with future background growth. As indicated above, the forward assessments (described below) include a sense-check on identified infrastructure to confirm its relevance in terms of the longer-term planned fully developed industrial activity for the Hautapu area.

7.3.2 Network Trip Distribution Resilience and Sensitivity

A range of scenarios have been assessed to determine the practical resilience of the transport network to support a range of potential development phasing impacts.

The assessed trip distribution scenarios adopted are summarised in the Table at **Appendix D** of this report. The key elements of the four distribution scenarios are as follows:

- Scenarios 1 and 2 are based on no internal connection between the PC14 area and the BIP. Scenarios 3 and 4 enable this;
- Scenarios 1 and 3 provide for PC14 to have access to Zig Zag Road, whereas Scenarios 2 and 4 do not;

- Scenarios 1 and 2 manage access for the BIP Stages 1 to 3 exclusively via the Victoria Road southern roundabout servicing that site. Scenarios 3 and 4 distribute the BIP traffic demands to Victoria Road via both planned roundabouts; and
- All scenarios assume 100% of the Hautapu C8 and C9 Growth Cells' industrial areas are accessed exclusively via the Victoria Road corridor.

These assessments were developed to stress-test the potential transport capacity of the planned transport network. The trip distribution analyses are included at **Appendix E** of this report. The assessments were evaluated and yielded the following broad key findings:

- Consolidation of all of the C8 and C9 Growth Cells' Hautapu Industrial traffic demands together with the C10 Growth Cell's demands on the Victoria Road corridor alone is not a feasible proposition as it can be expected to exceed the practical capacity of the corridor;
- The capacity of a four-lane corridor and the intersection forms associated with this warrant some higher level integrated transport modelling, such as through current/recent Business Case assessments to gauge both demand and potential timing expectations, if at all. This work is recommended to be integrated with planning and provisioning for contributions within an Infrastructure Works Agreement (for which specific provision is included in the proposed plan change) so that all of Council transport planning and associated assumptions can be consolidated and assessments made on a consistent basis;
- The Victoria Road/Zig Zag Road/Bruntwood Road intersection is unlikely to be sustainable in its current form and can be expected to need a change to a single lane roundabout to meet the 2041 (with full build out) traffic demands.
- A two-lane corridor on Zig Zag Road will readily meet the traffic demands;
- A two-lane E-W Structure Plan collector road will support expected demands;
- The transport network is able to support an outcome either with or without connectivity between PC14 site and the BIP area;
- The roundabouts on Victoria Road at Hautapu Road and at the BIP access will ultimately need to be dual laned facilities;
- The Victoria Road/Laurent Road/collector road roundabout is expected to be able to be established as a single lane roundabout;
- The WEX interchange ramp signals (northern and southern) can be expected to warrant upgrading to support dual turning facilities in the future; and
- Victoria Road from the E-W collector intersection south to Norfolk Drive is ultimately expected to require four-laning of the mid-block road sections.

These broad-based evaluative findings identify a long-term post 2041 scenario arising from a range of land use contributing areas and are contributed to in part only by PC14. It does however signal the strategic transport planning outcomes that WDC will ultimately need to be planning for. Many of these outcomes are already well under from a WDC planning and LTP funded outcomes perspective, as have been described earlier.

The findings also provide guidance as to how the Structure Plan needs to be integrated with the local transport network to:

- Efficiently utilise the existing transport network;
- Maintain traffic demands within the functional use outcomes intended for the current road corridors;
- Achieve a traffic distribution outcome that integrates with the wider Cambridge Growth Cell development intentions;
- Supports an integrated public transport system;
- Facilitates efficient cycling and walking together with alternative and ride-share personal transport modes.

The outcome of these assessments informed development of a refined Structure Plan and transport network integration assessment. This is described and assessed in the following sections.

7.4 Predicted Trip Distribution Sensitivity Assessment

Two further sensitivity evaluations were developed to test the impact of a refined and comprehensive scenario. These are described as follows:

- Sensitivity Assessment 1: Evaluates the provision for the Hautapu Industrial area to integrate with the developing and future C2, C3 and C7 Growth Cells, enabling some trip distribution from the C8 and C9 Growth Cell areas (20%) to occur via Peake Road; and
- Sensitivity Assessment 2: This scenario extends the Sensitivity Assessment 1 scenario, enabling an equivalent light-vehicle only distribution (25%) to/from Swayne Road to effectively integrate with the rapidly developing and established Cambridge environments accessible there. It also incorporates an assessed 15% provision for public and alternative transport modes including walking, cycling and micro-mobility.

These evaluations were assessed for each of the four trip distribution scenarios described at **Appendix D**. The results of the trip distribution assessments are included with the comprehensive results set out at **Appendix E** of this report. The key finding from these assessments was that public transport and alternative (walking, cycling and public transport servicing) transport modes are expected to be an essential element of the transport system servicing the whole of the Hautapu area. To this end, a well-formed and integrated transport network is required to support the whole of the Hautapu Industrial area, including the Structure Plan proposal.

By way of an overall assessment, it is concluded that the trip distribution outcomes represented by the Sensitivity Assessment 2 provides the best prediction for the long-term transport demand scenario in the Hautapu area.

The extent to which the transport network infrastructure needs to respond to these demands is assessed and described in the following sections.

8 Assessment of Transportation Effects

The transport network performance assessments, including the mid-block and intersection locations, are assessed, and described in the following sections. The following assessments are all based on the Sensitivity Assessment 2 trip distribution scenario.

8.1 Transport Network Infrastructure Performance & Staging

The operational performance metrics for the key intersections and points of access have been modelled in SIDRA and are evaluated and described in the following sections.

8.1.1 Victoria Road / E-W Collector Road Intersection

The analysis at this intersection has been based on the Scenario 4 (**Appendix D**) distribution as it indicates marginally higher trip distribution demands at this intersection. The modelling indicates a potential long-term need for the intersection generally as shown on Figure 8-1:

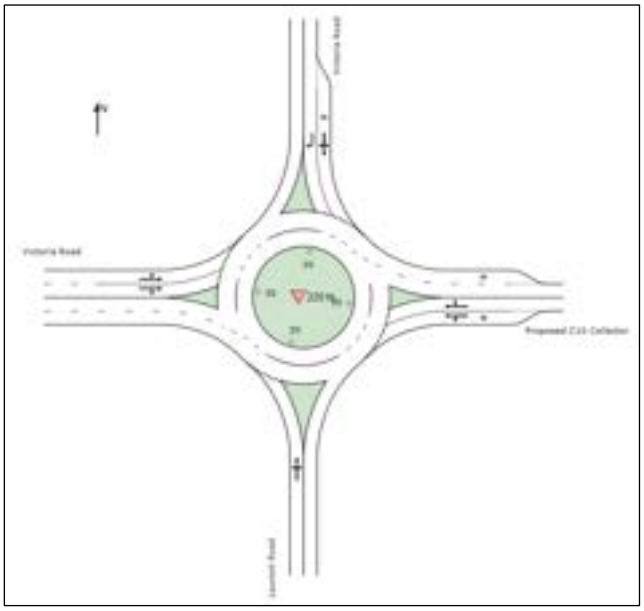

Figure 8-1: Indicative Long Term Intersection Form for Victoria Rd / E-W Collector Rd Intersection

Performance results for the intersection are included at **Appendix F** of this report and are interpreted as follows:

- An overall appropriate Level of Service (LOS) B in the AM and LOS A PM performance is assessed;
- The Victoria Road northern approach experiences LOS C in the AM peak;
- Queuing on all approaches is functional; and
- There is the potential, subject to realised future traffic demands, that some approaches could be constrained to single lane, in particular the northern and eastern approaches.

The intersection is able to be stage implemented. Key staging thresholds can be described as follows:

- The intersection can operate as a continued main road corridor from the west to the north and vice versa until such time as the collector road is formed;
- As a crossroad (four-leg) intersection arrangement, road safety outcomes will dictate that a roundabout intersection should be formed once the collector road is established as a fourth leg; and
- The potential life of the intersection as a priority-controlled intersection could be extended where the Laurent Road corridor is aligned to connect with the collector road approach or where it is not required at all, resulting effectively in the intersection operating as a three-leg intersection. Evaluation of these options can be advanced in conjunction with subdivision and resource consent application processes where desired.

The term “Level of Service” is defined in the Austroads Guide to Traffic Management Part 3: Transport Study and Analysis Methods as:

4.2.2 Level of Service

LOS is a qualitative stratification of the performance measure or measures representing quality of service. A LOS definition is used to translate complex numerical performance results into a simple stratification system representative of road users' perceptions of the quality of service provided by a facility or service (HCM 2016). These service measures include speed and travel time, delay, density, freedom to manoeuvre, traffic interruptions, comfort and convenience, and safety. In general, there are six levels of service, designated A to F, with LOS A representing the best operating condition and service quality from the users' perspective (i.e. free-flow) and LOS F the worst (i.e. forced or breakdown flow or having reached a point that most users would consider unsatisfactory, as described by a specific service measure value or a combination of service measure values).

8.1.2 Victoria Road / Hautapu Road Intersection

The analysis at this intersection has been based on the scenario 4 distribution as it indicates marginally higher trip distribution demands at this intersection. The modelling indicates a potential long-term need for the intersection generally as shown Figure 8-2:

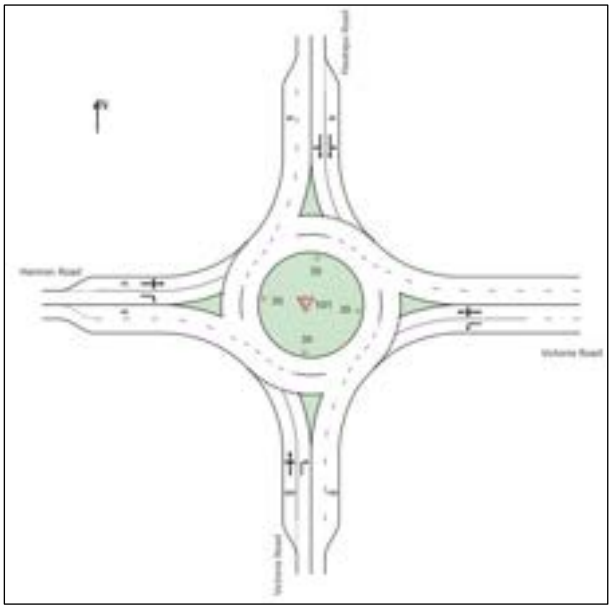

Figure 8-2: Indicative Long Term Intersection Form for Victoria Rd / Hautapu / Hannon Rd Intersection

Performance results for the intersection are included at **Appendix F** and are interpreted as follows:

- An overall appropriate LOS F AM and LOS F PM performance is assessed based on the worst performing approach;
- The Victoria Road southern approach experiences LOS F in the AM peak while the remainder of the approaches operate at a relatively efficient LOS A/B or C. The indicated queue will be highly subject to the extent that the traffic demands arise. The predominant traffic movement is to/from the western Hautapu Industrial area. A constraint on capacity at this level, if it eventuates, will support long term mode-shift outcomes. Where it becomes evident that additional capacity is required this could readily be integrated, for example with the roundabout in the form of continuous left turn facilities.
- In the PM peak, the intersection movements are more heavily demanded. The predominantly impacted approach is the Victoria Road eastern approach. This is because it is cumulatively impacted by departure traffic demands from the Hautapu Road and Hannon Road approaches.
- There is the potential, subject to realised future traffic demands, that some approaches could be constrained to single lane, in particular the northern and eastern approaches. The potential long- term response will depend heavily on whether the forecast traffic demands arise, noting these could in practice eventuate at about a 30% lower level than assessed (described further at paragraph 7.1 above). On this basis, it is assessed that the intersection will be heavily demanded in the long term. The indicated dual lane arrangement is expected to meet most if not all of the demand generated. Alternate and incremental responses can be determined closer to the horizon year as and if generated demands are at a level that may warrant further incremental capacity undertakings.

A further assessment has been conducted based on a 15 trips/ha assumption for the Hautapu Industrial areas. The intersection operates at LOS C in the AM and LOS E in the PM at 2041, indicating the potential for the dual lane concept shown to meet the reasonable long term traffic demand with a reasonable operating performance.

The intersection is able to be stage implemented. Key staging thresholds can be described as follows:

- Established at the outset to support the Hautapu Industrial (C8 and C9 Growth Cell areas), the intersection will be a crossroad intersection and warrant a roundabout safe system control. This could be a single lane arrangement with additional and incremental capacity introduced. Long term however, a full 2-lane roundabout is expected to be necessary and land provisioning should be made to accommodate this.

8.1.3 Victoria Road / Zig Zag Road Intersection

The analysis at this intersection has been based on the scenario 1 distribution as it indicates marginally higher trip distribution demands at this intersection. The modelling indicates a potential long-term need for the intersection generally as shown on Figure 8-3:

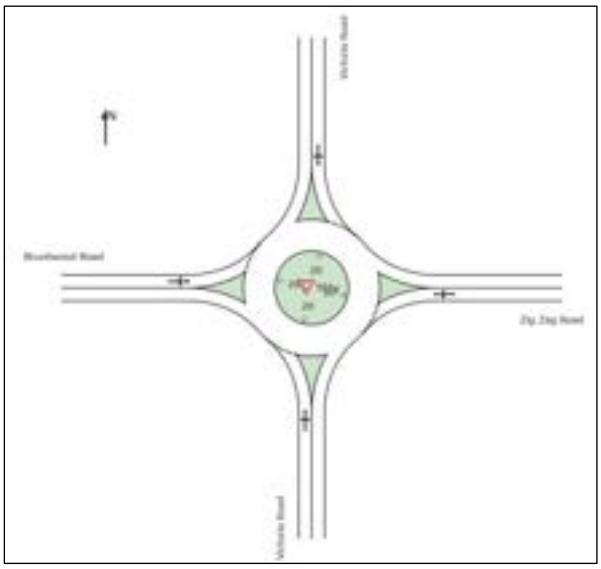

Figure 8-3: Indicative Long Term Intersection Form for Victoria Rd / Zig Zag Rd / Bruntwood Rd Intersection

Performance results for the intersection are included at **Appendix F** and are interpreted as follows:

- An overall appropriate LOS B AM and LOS A PM performance is assessed;
- The Bruntwood Road western approach experiences LOS C in the PM peak;
- Queuing on all approaches is functional;
- There remains significant capacity in the intersection to support further demands where that emerges as necessary.

The intersection will be required from the point at which access is intended to the PC14 area from Zig Zag Road. Establishing access on Zig Zag Road is a beneficial transport distribution outcome for the wider Hautapu area and delivers a better balance of traffic flow to the Victoria Road roundabouts to the south.

Modelling of the current crossroad intersections indicates that the side roads are currently (as a crossroad intersection) at LOS F performance and there is an identifiable road crash record at or near the intersection. The introduction of turning and heavy vehicle classes further emphasises the need for this to be established from commencement of access onto Zig Zag Road.

Further sensitivity analysis to assess the potential long-term impact arising from the inclusion of the Bourke Property has been undertaken to understand the land allocation provisions associated with an ultimate form. The results of this are included at **Appendix F** also. The results indicate a single lane roundabout is expected to operate at LOS D (AM) and LOS B (PM). Bruntwood Road indicates a LOS F impact in the AM, however the overall performance on other approaches and the more efficient PM performance indicates that the intersection is likely to be able to be maintained long-term as a single lane facility.

8.1.4 Victoria Road / BIP Access

The analysis at this intersection has been based on the scenario 1 distribution as it indicates marginally higher trip distribution demands at this intersection. The modelling indicates a potential long-term need for the intersection generally as shown on Figure 8-4:

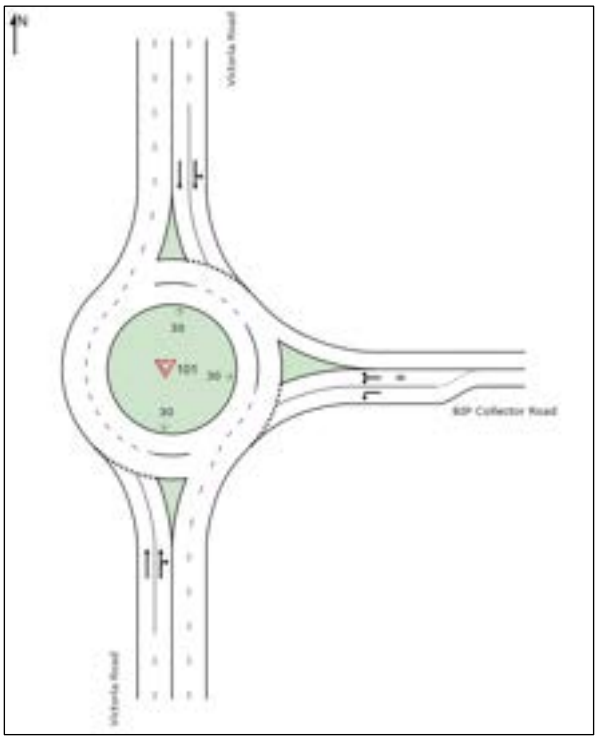

Figure 8-4: Indicative Long Term Intersection Form for Victoria Rd BIP Rd Intersection

Performance results for the intersection are included at **Appendix F** and are interpreted as follows:

- An overall appropriate LOS A AM and LOS A PM performance is assessed;
- The BIP eastern approach experiences LOS C in the PM peak; and
- Queuing on all approaches is functional.

The intersection is able to be stage implemented. Key staging thresholds can be described as follows:

- It is understood a single lane roundabout is currently under construction, supporting access to/from the established development on the site;
- Single lane intersection modelling identifies that as demands increase the Victoria Road southern approach AM and northern approach PM will increasingly demand additional capacity and need to be established with dual lane approaches and departures. As a consequence, the single configuration may not be sustainable in the longer term with full development across the full Hautapu Industrial area.
- The consequence of increasing demand will become evident over time, predominantly as a consequence of the Hautapu Industrial (C8 & C9 Growth Cell) areas develop. Incremental capacity will be able to be provisioned for and introduced over time.
- The Hautapu Industrial western area is the predominant contributor to traffic demands. Through regional traffic and that generated by the C10 Growth Cell land use area contributes approximately equally to the north-south movements on Victoria Road at this location. The other primary contributor to traffic demands is the BIP development node itself.

A further assessment has been conducted based on a 15 trips/ha assumption for the Hautapu Industrial areas. The single land roundabout continues to fail at LOS F. The analysis for a dual lane roundabout indicates it operates at LOS A in the AM and LOS A in the PM at 2041. This indicates the future peak demands for the wider area are expected to be at or about the practical capacity of a single lane roundabout. The conclusion is that a dual lane roundabout would continue to be warranted under this assumption long term.

8.1.5 WEX / Northern Intersection

The analysis at this intersection has been based on the scenario 1 distribution as it indicates marginally higher trip distribution demands at this intersection. The modelling indicates a potential long-term need for the intersection generally as shown on Figure 8-5:

Figure 8-5: Indicative Long Term Intersection Form for WEX Northern Intersection

Performance results for the intersection are included at **Appendix F** and are interpreted as follows:

- An overall appropriate LOS C AM and LOS D PM performance is assessed;
- The Victoria Road northern approach experiences LOS D in the AM peak and some smaller movements indicate LOS E in the PM peak;
- Queuing on all approaches is functional and does not indicate the potential to extend between to the southern ramp signalised intersection;
- Analysis of the baseline traffic demands without the PC14 development area also indicates a need for the intersection to be upgraded to an equivalent degree; and
- A third lane has been indicated on the northern approach and has been identified as possibly being needed to facilitate an integrated approach with the southern intersection and demands for the right turn southbound to the westbound on-ramp. Sensitivity testing of the need for this additional lane has

identified it is on or about the threshold of being needed in the AM peak period only and will be dependent ultimately on the eventual and overall trip generation outcomes for the area. The indicative future interchange arrangement shown on Figure 8-7 below indicates there is ample room to accommodate the planned interchange arrangement without impacting the rail designation.

A further assessment has been conducted based on a 15 trips/ha assumption for the Hautapu Industrial areas. The intersection is assessed as continuing to operate at LOS C in the AM and LOS D in the PM at 2041. It indicates the arrangement shown is expected to be necessitated long term.

The intersection can be stage implemented. Key staging thresholds can be described as follows:

- Introduction of dual through lanes in the first instance; and
- Followed by introduction of the dual left turn off-ramp lanes commensurate with signalisation of the pedestrian crossing movement.

8.1.6 WEX / Southern Intersection

The analysis at this intersection has been based on the Scenario 1 distribution as it indicates marginally higher trip distribution demands at this intersection. The modelling indicates a potential long-term need for the intersection generally as shown on Figure 8-6:

Figure 8-6: Indicative Long Term Intersection Form for WEX Southern Intersection

Performance results for the intersection are included at **Appendix F** of this report and are interpreted as follows:

- An overall appropriate LOS C AM and LOS F PM performance is assessed;

- The Victoria Road south approach and the northern approach right turn experiences LOS F in the PM peak. The southbound right turn to the on-ramp is heavily demanded in the PM peak and this coincides with high demands departing Cambridge in a northbound direction in the PM peak. While dual right turn movements may be able to be accommodated to the ramp this can be difficult to safely manage with dual merge outcomes to join the main WEX flow. Ramp metering on the westbound on-ramp could be an option here to safely manage this;

- Queuing is expected to be generally manageable on the approaches. The Victoria Road approaches indicate a degree of sensitivity to the eventual future year vehicle trip generation outcome. The potential impacts arising from traffic demands across the whole of the Hautapu Growth Cell areas are a factor in this. Any potential impact, if it eventuates (given the high trip generation assumptions) will be gradually represented on the transport network and will be readily able to be planned and provisioned for within the WDC LTP;

- The sensitivity of the intersection to localised lane additions to address the constrained approach movements has been assessed and the results included at **Appendix F** of this report. The results indicate a change to LOS B (AM) and LOS C (PM), further indicating the above assessments are at the apparent long- term threshold for capacity based on the high trip generation assumptions adopted collectively across the whole of the Hautapu Growth Cell area; and

- Evaluation of the intersection performance without PC14 indicates LOS B-D (AM) and LOS E-F (PM), suggesting an apparent need for the intersection to be improved prior to the introduction of traffic demands due to PC14.

A further assessment has been conducted based on a 15 trips/ha assumption for the Hautapu Industrial areas. The intersection operates at LOS B in the AM and LOS C in the PM at 2041. The results indicate the arrangement shown is expected to operate satisfactorily and also retains some further potential capacity to meet variable longer-term demands should they arise.

As with the northern intersection, this site can be stage implemented and would be integrated with capacity changes to the northern intersection. Key staging thresholds can be described as follows:

- Introduction of dual through lanes in the first instance; and

- Followed by introduction any incremental capacity as and if needed.

The indicative and long-term arrangement for the interchange has been assessed and is shown on the following Figures. The arrangements show the long-term future potential arrangement with a dual right turn to the westbound on-ramp together with the KiwiRail designation allocation as its width is provided for at present:

Figure 8-7: Indicative Overall Interchange Arrangement (Source: Google maps)

Figure 8-8: Indicative Southbound Lane Arrangement (Source: Google maps)

Figure 8-9: Indicative Northbound Lane Arrangement (Source: Google maps)

It can be seen from the Figures that the additional lane arrangements are well accommodated within the future-proofed interchange form, including that for a maintained rail designation. Considered integration with the rail designation, as it is at present with the shared path crossing the space, will warrant on-going consideration. It is evident that two vehicle lanes can be added east of the columns to the WEX overbridge and that a pedestrian/cycle allocation is also able to be retained. A range of management options exist, however it is clear that the current spatial allocation beneath the interchange bridge is adequate to meet the future demand expectation for both vehicular traffic together with preservation of a corridor at least equivalent to the current rail designation width.

8.1.7 Victoria Road Corridor & Rail Designation

These analyses indicate the strategic significance of the Victoria Road corridor together with the existing rail designation and to the east of that the Lauren Road corridor.

Victoria Road is the primary vehicular traffic corridor at present. KiwiRail is understood to have retained the designation for rail in its recent engagements in relation to the BIL roundabout. The Laurent Road corridor is only partially formed along its length and its use is minimal and increasingly impractical in the current environment.

The respective corridor widths are:

- Victoria Road: is about 28.5m just north of the WEX interchange and tapers to a minimum of about 15m just north of the cemetery access;
- KiwiRail designation: is a consistent 6.0m width
- Laurent Road: is a consistent 17m width.

At its narrowest cross section, Victoria Road is not wide enough to support 4 lanes of traffic together with the pedestrian, cycle and utility servicing infrastructure. Together with the Laurent Road corridor however, there is ample space to accommodate all of the movement and utility servicing functions the road corridor space will be required to support. The future arrangement of the movement and utility functions between the Victoria Road and Laurent Road corridors is able to be determined at a future date. Readily identifiable options include:

- separating the vehicular, pedestrian and cycle and utility functions across the two corridors;
- establishing the northbound vehicular movements together with some of the other functions in the Victoria Road corridor and the southbound vehicular movements and supporting functions in the Laurent Road corridor; or
- consolidating the functional space of the two vehicular corridors together and retaining the functional rail corridor, albeit in an adjoining location.

The over-riding conclusions with respect to these corridors are:

- that the vehicular transport corridors remain strategic and necessary assets to suitably provide for future transport demands, including the potential for bus priority functions;
- the KiwiRail corridor remains a strategic functional space requirement into the future; and
- collectively, the corridor space available is assessed as appropriate to meet the long-term future demands for the wider area, part of which includes the PC14 Mangaone Precinct.

8.1.8 Zig Zag Road / Structure Plan Site Access

The analysis at this intersection has been based on the scenario 4 distribution as it indicates marginally higher trip distribution demands at this intersection. The modelling indicates a potential long-term need for the intersection generally as shown on Figure 8-10:

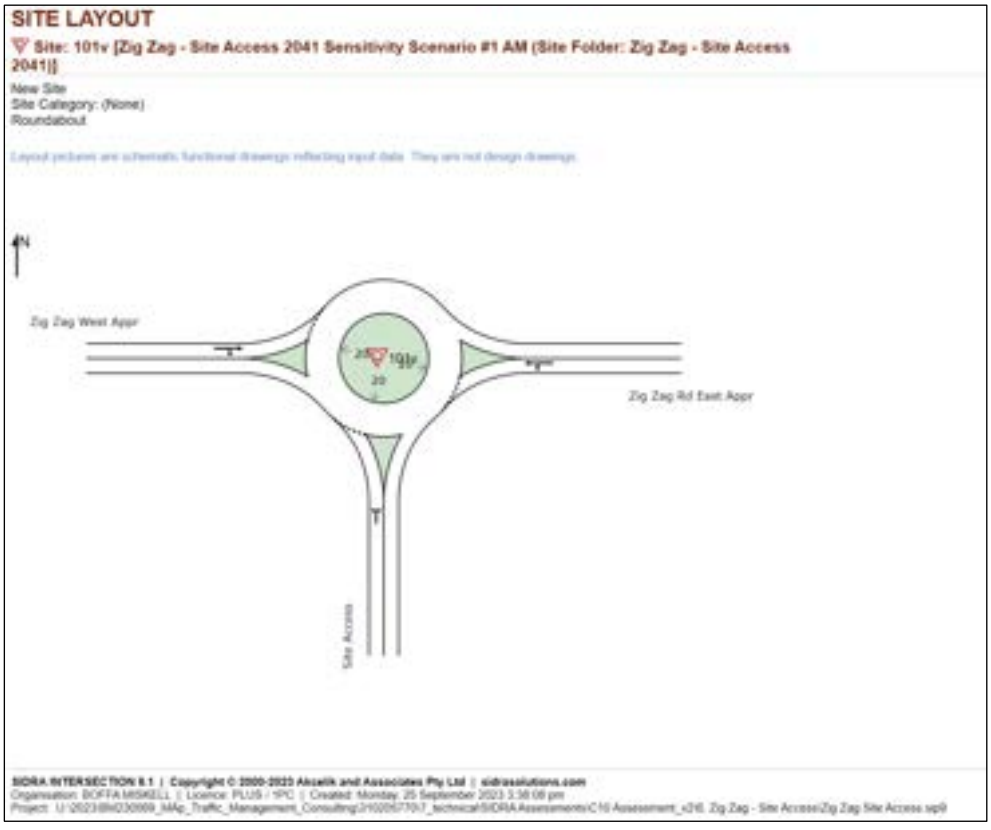

Figure 8-10: Indicative Long Term Intersection Form for Zig Zag Road / Site Access Intersection

Performance results for the intersection are included at **Appendix F** of this report and are interpreted as follows:

- An overall appropriate LOS A (AM) and LOS A (PM) performance is assessed. All approaches will operate at this level; and
- Queuing is indicatively within 20m on all approaches.

The intersection has been assessed as a potential Give Way “T” intersection form. From a capacity perspective the intersection could function adequately in this form. The introduction of heavy commercial vehicles (HCVs) turning right across on-coming relatively high-speed vehicles however will introduce an adverse and serious crash consequence and would not align with a safe-system intersection form.

Notwithstanding the potential for speed reduction on Zig Zag Road, the relatively high proportion (potentially 20%) of HCVs will warrant an appropriately sized roundabout control at commencement. This will positively contribute to safer speeds in the environment and will also prioritise right turn movements into the site over the opposing through traffic movements.

Establishment of a roundabout at the site access location will also enable a substantial proportion of the land area to be developed in advance of the internal E-W collector road, where staged development occurs via this access in the first instance. In enabling this, it is necessary to ensure the external transport network effects of staged development do not exceed the long-term forecast traffic demands to such an extent as to result in adverse transport effects outcomes. Based on scenario 1 – Sensitivity Assessment 2 2041 long-term traffic demands, the Structure Plan generated traffic demands at this intersection are expected to account for about 4,280 trips per day. Based on the assessed 200 trips/ha/day trip generation rate, this is equivalent to servicing about 21.4ha of land. The intersection performs at LOS A at this generation level.

Indicatively, the developable land parcel to the north of the Mangaone Stream is about 15.9ha in area, subject to the eventual shape and arrangement of the stormwater reserve around the stream. This suggests that a further seven hectares of land could be developed south of the Mangaone Stream while generating traffic demands onto the external road network at levels commensurate with the long-term forecast traffic demands and maintaining operations at LOS A at the intersection.

The ability for additional land development south of the Mangaone Stream has therefore been further assessed as follows. The addition of further 15ha development area (about 22ha in total) south of the Mangaone Stream has been assessed to determine the potential short-term impact at the Zig Zag Road site access and at the Zig Zag Road/Bruntwood Road/Victoria Road intersections. The modelling results are included at **Appendix G** of this report and indicate:

- The site access single lane roundabout intersection will continue to perform at LOS A in both the AM and PM peak periods; and
- The Victoria Road/Zig Zag Road/Bruntwood Road single lane roundabout intersection continues to operate at LOS B – AM and LOS A PM.

Overall, it is assessed that staged access initially via Zig Zag Road, involving up to 22ha south of the Mangaone Stream can be enabled prior to construction of the E-W collector road.

Further to the ability to enable access via Zig Zag Road, the equivalent infrastructure on Victoria Road will need to be in place to support the generated traffic demands. These include:

- The Victoria Road / Hautapu Road intersection; and
- The Victoria / BIP roundabout intersection.

It is noted that the Victoria Road / plan change collector road roundabout would not be required in this case as there would be no trip demands generated from the zoned land at this location.

8.1.9 Swayne Road / Site Access

Fewer traffic movements are expected on Swayne Road (compared to Zig Zag Road) at the site access point, as shown on the distribution Figures at **Appendix E** of this report. These are also intended to be positively constrained to avoid HCVs and therefore a simple T-intersection form is assessed as being appropriate from both a capacity and a safety performance outcome. Speed reduction and through site connectivity restraint management on this section of the corridor would be appropriate to align with the point of access location. With nil to minimal right turn entry movements, it is assessed that a simple T-intersection form with appropriate road shoulder treatments and without the need for a right turn bay arrangement would be appropriate.

8.2 Road Corridor Formation

The intersection assessments described above indicate a need for an integrated mid-block long-term corridor improvement approach. Some sections of the road corridor are assessed as warranting improvement both prior to (as a result of development without PC14l) and in order to support the long-term traffic demands generated. The key sections to be four-laned are as follows:

- Victoria Road between the twin roundabouts; and
- Victoria Road from the Hautapu Road roundabout south to the southern intersection at the WEX interchange, including the southern approach to the intersection.

The intersection analyses described above indicates that there will be a case for these road sections to be staged subject to a managed long-term planning approach by WDC. The potential impact due to traffic demands generated by this proposed plan change are one contributory element within the wider context of the Hautapu growth cells collectively. It is apparent that Council does not currently have planning provisions in these regards within their 30-year Strategy, however recent transport modelling undertakings by Council have similarly identified a need to commence forward planning and provisioning in this regard. This will need to be factored into and appropriately allocated within the Developer Agreement that is set out as a requirement of the proposed Rules.

8.3 Safe Speed Road Environments

The current external speed environment is too high to safely accommodate the key points of access for the PC14 area. In response to this and to achieve a safe speed operating environment around as well as within the PC14 area, the following indicative posted speed environments are proposed:

- Victoria Road – Hautapu Road to Zig Zag Road – 60km/h;
- Zig Zag Road – Victoria Road to Swayne Road – 60km/h;
- Swayne Road – Appleby Road to Zig Zag Road – 60knm/h;
- Structure Plan – collector road – 50km/h; and
- Structure Plan – local roads – 40km/h.

Implementation of these speed limits (or other arrangements as determined appropriate by WDC) may necessitate some localised traffic management such as thresholds or local gateways established with the speed change locations. These could be integrated with and an infrastructure element of the PC14 implementation. They would require a resolution of WDC through the appropriate committee, a process to be managed and implemented by WDC as part of its annual speed limit review or specifically for the site as may be required. The applicant is to engage with WDC in advance to enable the appropriate speed limits to be authorised and established.

8.4 Construction Traffic Management Effects

Overall, the site is relatively level and predominantly the earthworks are expected to be able to be conducted with minimal bulk movement of soil to or from the site. There will be substantial works in and around the formation and development of the stream, swales, and stormwater management areas, again, predominantly involving earthworks within the site area.

The construction of internal roading, which will predominantly be for public purposes and vested as such, will necessitate some earthworks excavation together with the importation of materials suitable for the formation of the sub-grade and pavement layers. Similarly, there will need to be importation on a site-by-site basis to form the building foundation and vehicle movement areas.

With increasing traffic demands on the local Hautapu transport network as a consequence of land development in the C8 and C9 Growth Cell areas, together with the anticipated HCV component of the overall traffic make-up, it is assessed that well-planned construction traffic management outcomes will be necessary. These are assessed as being able to be provided for in conjunction with the subdivision and resource management stages of development and are not a necessary matter to be required in respect of the proposed land use change.

9 Overall Transport Infrastructure Requirement

9.1 Transport Infrastructure Categorisation

The assessments set out above provide that PC14 is expected to generate traffic demands and these movements will distribute across the transport network. Simultaneously, current traffic demands, other approved development and other enabled land use generated traffic demands together with other transport infrastructure interventions all contribute to a changing transport network function over time.

In order to achieve a well-integrated transport response, having regard for the whole of the transport system, it is recommended the Structure Plan enables a mechanism to provide for staged and appropriately timed infrastructure to be planned in coordination with WDC through an Infrastructure Works Agreement (IWA) or other similar mechanism. The proposed plan change provisions include a rule to address this matter.

The assessments described in this report identify transport infrastructure elements needed in terms of safety, connectivity, and capacity. The need for these has been identified as being contributed to in part by PC14 and substantially warranted by current demands together with other growth generated demands. The timing and uptake of development within the PC14 area will also have the effect of bringing forward the need for some works. However, in taking an integrated planning approach across the transport network, it may be reasonable in some instances to delay local infrastructure responses where the short-term need for these has the potential to be superseded by more strategic interventions at a later time.

On these bases it is recommended an IWA be established on the following framework for transport (inclusive of vehicular and other multi-modal transport) infrastructure. The framework identifies three categories corresponding with the transport infrastructure items as follows:

- **Category A Works:** Those works needed solely or primarily as a result of PC14 and PC14 primarily benefiting it;
- **Category B Works:** Those works required to address current network deficiencies, and also enabled (land use zoned or consented) but as yet unrealised traffic demands in order to support PC14 and which not only enable PC14 but deliver a wider community benefit outcome; and
- **Category C Works:** Those works which deliver an integrated plan change outcome with other development areas within the Hautapu Industrial area, but which are predominantly needed as a result of other (non-PC14) generated demands.

The indicative works are described at **Appendix H** of this report. The three categories of work are separately summarised in Tables 9-1, 9-2 and 9-3 as follow:

Table 9-1: Indicative IWA Framework: Category A Works for Transport (inclusive of associated multi-modal transport) Infrastructure

Infrastructure Element	Nature of the Works	Indicative Long-Term Infrastructure	Function/Purpose	Structure Plan Aspect Linked To	Primarily Necessitated by	Cat.
Victoria Road / E-W Collector Road intersection	Staged implementation of an intersection to establish the E-W Collector Road point of access for the plan change area	Dual lane roundabout	To establish SP integration with the transport network	E-W Collector Road formation	Structure Plan	A
The Structure Plan E-W Collector Road	A Collector Road providing the primary point of vehicular access for the plan change area	2-lane plus painted median industrial Collector Road formation	To establish SP integration with the transport network	Land development within the plan change area subject to the structure plan provisions	Structure Plan	A
Internal public road formation within the plan change areas, to be vested	Industrial access roading network	Industrial Local Road formation	To establish SP integration with the transport network	Land development within the plan change area subject to the structure plan provisions	Structure Plan	A
Zig Zag Road / Structure Plan Site Access	Site access and pavement strengthening	Single lane roundabout	To establish access to land north of the Mangaone stream	Land development north of the Mangaone Stream	Structure Plan	A
Zig Zag Road Rural Industrial Road Formation	Carriageway shoulder widening and potential pavement strengthening	2-lane rural industrial road with sealed roadside shoulders	Support District growth together with structure plan network integration	Zig Zag Riad / Structure Plan site access intersection formation	Structure Plan	A
Swayne Road / Site Access	Site access	2-lane T-intersection	Support District growth together with structure plan network integration	Land development and associated structure plan tip generation	Structure Plan	A
Swayne Road Rural Industrial Road formation	Carriageway shoulder widening, potential localised pavement strengthening together with light/medium vehicle access restriction within the site and including a shared path connection to the south to adjoin existing facilities on Swayne Road.	2-lane rural industrial road with sealed roadside shoulders	Support District growth together with structure plan network integration	Swayne Road / Structure Plan Road site access intersection	Structure Plan	A

Table 9-2: Indicative IWA Framework: Category B Works for Transport (inclusive of associated multi-modal transport) Infrastructure

Infrastructure Element	Nature of the Works	Indicative Long-Term Infrastructure	Function/Purpose	Structure Plan Aspect Linked To	Primarily Necessitated by	Cat.
Victoria Road / Hautapu Road Intersection	Provision of intersection capacity to support the wider Hautapu Industrial area and integration of the proposed plan change area	Dual lane roundabout	Support District growth together with structure plan network integration	Land development and associated structure plan tip generation	Hautapu Industrial and proposed plan change areas	B
Victoria Road Urban Industrial Road formation	Carriageway shoulder widening, kerb and channelling	2-lane carriageway	Support District growth together with structure plan network integration	Land development north of the Mangaone Stream	Hautapu Industrial and proposed plan change areas	B
Victoria Road / Zig Zag Road / Bruntwood Road Intersection	Provision of intersection capacity to support the wider Hautapu Industrial area and integration of the proposed plan change area	Single lane roundabout	Support District growth together with structure plan network integration	Land development north of the Mangaone Stream	Hautapu Industrial and proposed plan change areas	B
Victoria Road – The section between the twin "dog-bone" roundabouts either side of the railway designation	District-wide land use, growth, development and employment generated trips	4-lane carriageway	Support District growth together with structure plan network integration	Incremental capacity to support the plan change	BIP , Hautapu Industrial Area	B

Table 9-3: Indicative IWA Framework: Category C Works for Transport (inclusive of associated multi-modal transport) Infrastructure

Infrastructure Element	Nature of the Works	Indicative Long-Term Infrastructure	Function/Purpose	Structure Plan Aspect Linked To	Primarily Necessitated by	Cat.
Victoria Road / BIP Access	Key point of access to BIP industrial land together with capacity to support the wider Hautapu and proposed industrial zoned land	Dual lane roundabout	To support access to BIP land	Incremental capacity to support the plan change	BIP , Hautapu Industrial Area	C
WEX / Northern Intersection	District-wide land use, growth, development and employment generated trips	4-lane signalised intersection	Support District growth together with structure plan network integration	Incremental capacity to support the plan change	BIP , Hautapu Industrial Area	C
WEX / Southern Intersection	District-wide land use, growth, development and employment generated trips	4-lane signalised intersection	Support District growth together with structure plan network integration	Incremental capacity to support the plan change	BIP , Hautapu Industrial Area	C
Victoria Road from the Hautapu Road roundabout south to the southern intersection at the WEX interchange	District-wide land use, growth, development and employment generated trips	4-lane carriageway	Support District growth together with structure plan network integration	Incremental capacity to support the plan change	BIP , Hautapu Industrial Area	C

With these transport infrastructure provisions in place, providing for an integrated and appropriately staged transport system, the assessments demonstrate the Structure Plan will be readily accommodated on the transport network.

10 Multi-modal Corridor Cross Sections

The internal and external Structure Plan transport corridor design elements are described in the following sections. These include the proposed corridor cross sections to be established to support the different functions of roads within the Structure Plan area.

10.1 Overview

The Structure Plan and supporting road hierarchy intends the following indicative road classifications:

- Internal Industrial Collector Road with swale: 21.1m plus swale, path and berm beyond that;
- Internal Industrial Local Road with swale: 32.0m corridor;
- Internal Industrial Local Road: 23.7m corridor;
- Minor Accessway link to Swayne Road: 20m corridor with carriageway meander;
- Zig Zag Road Rural Industrial Road: 20m corridor, no change;
- Swayne Road Rural Industrial Road: 20m corridor, no change; and
- Victoria Road Urban Industrial Road 20m corridor, no change on the two-lane sections. Future four laning will be subject to detailed design at that time.

Indicative cross section formations are included at **Appendix I** of this report. Future public transport servicing on the cross sections described is enabled on all of the corridors, except on the link through to Swayne Road as this is to be constrained to limit and manage larger vehicle access. Detailed design development could accommodate public transport on this link and can be determined at the time of its formation or once there is further clarity as to the eventual planned public transport servicing routes to be established by Waikato Regional Council.

The cross sections for each typology are described in further detail below. The cross-sections for each road are to be developed and authorised through subdivision consent, in conjunction with WDC. Vehicle crossing places within the Structure Plan area may be considered for treatment aligned generally with the Waka Kotahi *High-Use Driveway Treatment for Cycle Paths and Shared Paths design guidance.* [16] *The cross sections are further described in the following sections.*

10.2 Pedestrian and Cycle Network

The Structure Plan area has been designed to integrate a hierarchy of cycle, pedestrian and shared pathways internally to:

- Link the overall site with the external path networks;
- Establish predominantly uninterrupted movement paths for primary internal distribution; and
- Establish safe access to property and internal connectivity.

[16] Waka Kotahi, High-Use Driveway Treatment for Cycle Paths and Shared Paths design guidance

Key elements of the Structure Plan can be summarised as follows:

- The collector road supporting a 2.5m shared path on the development side and a 3.0m shared path on the swale side of the corridor;
- The local road network supporting a 2.5m shared path on each side of the road corridor;
- The external rural road upgrade works supporting a 3.0m shared path on the site side of the Victoria Road corridor;
- The minor accessway link to Swayne Road supporting a 2.5m shared path on the south side; and
- An off-road shared path through the future reserve/stormwater reserve area linking Swayne Road, Zig Zag Road and the internal collector road.

To evaluate the path widths and types, reference has been made to the Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling. Figures 5.4 and 5.5 (Austroads Part 6A) provide a graphical mechanism that has been adopted to determine path widths based on pedestrian and cycle demand expectations. Figure 5.4 is based on a 50/50 directional split in demands and Figure 5.4 is based on a 75/25 directional split.

Analyses have been undertaken to align with recent Business Case advice to Council, on the basis of two demand scenarios as follows:

- **Scenario 1:** Cycle mode share is 7.5% and pedestrian mode share 2.5% of the assessed vehicular demands on the corridor (i.e.: a 10% anticipated mode share); and
- **Scenario 2:** Cycle mode share is 10% and pedestrian mode share 5% of the assessed vehicular demands on the corridor (i.e.: a 15% stretch mode share target).

The technical analyses are set out at **Appendix J**. The key findings are summarised as follows:

- 2.5m paths are a minimum requirement on both sides of the corridor for all of the internal Structure Plan roads to be established, including the collector road;
- A 2.5m shared path on one side of the road corridor is appropriate on Zig Zag and Swayne Roads;
- In Scenario 1, the requirements for Victoria Road would be satisfied by a 2.5m path each side in the 50/50 split case and a 3.0m path is required on one of the sides in the 75/25 split case between the WEX interchange and Hautapu Road;
- In Scenario 2, the requirements for Victoria Road would be satisfied by a 3.0m path each side in the 50/50 split case. In the 75/25 split case a 2.5m bicycle lane and separate 1.5m pedestrian path was assessed to be required on one side with a 2.5m shared path on the other between the WEX interchange and the Hautapu Road intersection. North from there, a 3.0m/2.5m path combination would be needed to Victoria Road. The linking section to the Structure Plan collector road is appropriately serviced by 2.5m shared paths each side.

The assessment therefore demonstrates the Mangaone Precinct Structure Plan is appropriately designed in terms of the shared path arrangements described in the following cross section cases. Similarly, the Zig Zag Road, Swayne Road corridors are appropriately detailed. Over time, and subject to eventual pedestrian and cycle movement demands, there is the possibility that a separated cycle lane may be warranted on one side of Victoria Road, at least the section between the WEX interchange and the Hautapu Road intersection. This long-term outcome for Victoria Road corridor would require a material shift in mode share to be recognised (achievement of the stretch target described in Council's Business case) and therefore it is assessed as appropriate that at least a spatial land allocation be set aside to support that outcome if needed in future.

When viewed on the Structure Plan, it can be seen that PC14 intends a connected hierarchical pedestrian and cycle shared path network providing for safe movement within and through the Structure Plan area. It further provides to link the Structure Plan with the planned/established external movement network. Within the Structure Plan area, the design guidelines are to provide for accessibility crossing places at intervals across the swale sections of the collector and local road corridors.

A purposeful decision has been taken through the urban design approach to safely separate cycling from the trafficable carriageway where a relatively high proportion of heavy vehicles will be present. The shared path environment will be relatively lowly occupied by pedestrians given the comparative walking distances between the living and working environments and also given the relatively limited site-to-site interactions anticipated. Shared paths are shown for both sides of the corridor to safely facilitate local and same-side short trips to occur without necessitating crossings of the road carriageways. A wider and more strategic (3.0m) path facility is proposed on one side to reflect this as the primary cycle function where distribution, commuting and wider strategic cycle network integration is concerned. The shared path approach is a consistent design concept to that planned within the other (C8, C9) growth cells, ensuring movement between these areas is readily able to be interpreted and consistent ride outcomes achieved.

10.3 Internal Urban Industrial Collector Road

The key function of this road corridor is to connect and distribute Structure Plan traffic with the primary external transport network as well as servicing internal access and movement for property developed within the Structure Plan area. The proposed formation is shown on Figure 10-1:

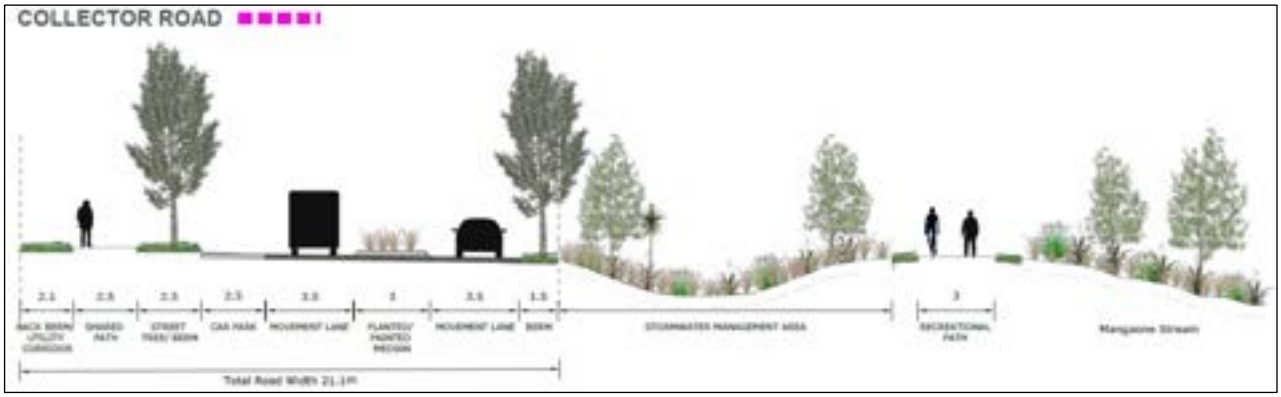

Figure 10-1: Indicative Internal Industrial Collector Road

Key elements of the cross section can be summarised as follows:

- A 10.5m carriageway;
- Two 3.5m lanes (a departure from the WDC standard of 4.0m), plus a 3.0m painted central median with intermittent planting. The inclusion of a painted median arrangement off-sets the impact of the proposed reduced lane widths and delivers a higher standard cross section overall;
- Alternately surfaced parking shoulders 2.5m on one side and a stormwater swale on the other. The parking shoulders are proposed as continuous to provide for longer vehicle parking demands as they are generated by the industrial activity;

- Substantive planted shoulder areas enabling the establishment of larger tree species with the potential for canopy development to contribute to the targeted speed environment;
- Shared paths on both sides of the corridor; and
- Utilities service berm areas.

Urban Design advice has been that slender trunk and frangible trees could be considered in the central median for the Collector Road and the Minor (light vehicle) Accessway. For the Collector Road, the central median trees could serve to reinforce the Cambridge vernacular of Avenues with trees. They would be desirable from that perspective and could add quality and visual amenity to the industrial area. The detail of the form of the trees, the girth of the trunk and frangibility response are matters that are able to be further considered and embedded as part of the detailed design and consenting stages. Notwithstanding these considerations and to provide certainty at this Plan Change stage, the medians are shown with low frangible planting to address traffic safety outcomes.

On this basis it is assessed the concept for design will establish an appropriately safe and accessible movement corridor, having regard for the heavy vehicle use, collector road hierarchy and long-term district roading function intended.

10.4 Internal Industrial Local Road with Swale

The key function of this road corridor is to service internal access for property developed within the Structure Plan area. The proposed formation is shown on the following Figure:

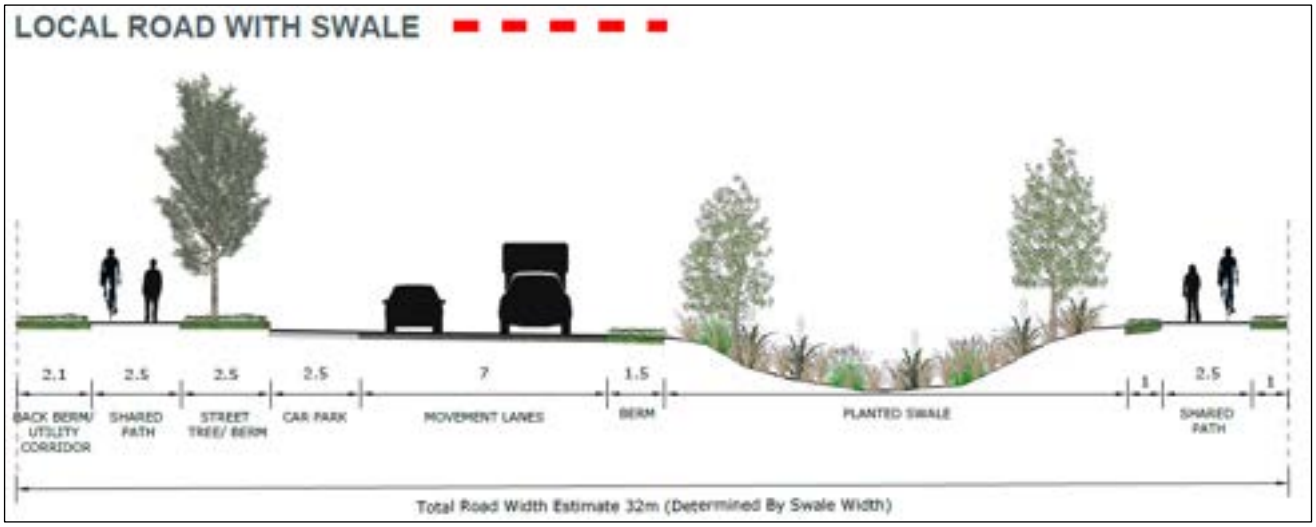

Figure 10-2: Indicative Internal Industrial Local Road with Swale

Key elements of the cross section can be summarised as follows:

- A 7.0m carriageway (two 3.5m lanes);
- An alternately surfaced parking shoulder 2.5m on one side and a stormwater swale on the other. The parking shoulder is proposed as continuous to provide for longer vehicle parking demands as they are generated by the industrial activity;
- Substantive planted shoulder areas enabling the establishment of larger tree species with the potential for canopy development to contribute to the targeted speed environment;

- Shared paths on both sides of the corridor; and
- Utilities service berm areas.

10.5 Internal Urban Industrial Local Road

The key function of this road corridor is to service internal access for property developed within the Structure Plan area. The proposed formation is shown on Figure 10-3:

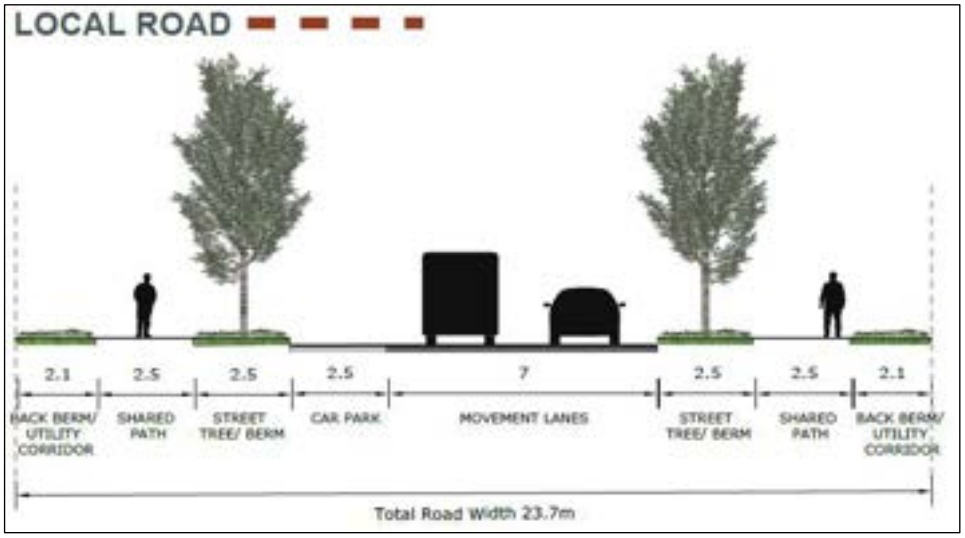

Figure 10-3: Indicative Internal Industrial Local Road

Key elements of the cross section can be summarised as follows:

- A 7.0m carriageway (two 3.5m lanes) with detailed design provision for the carriageway to be established wider where there are low radius corners necessitating additional width to accommodate trailer tracking encroachment. Guidance on this is able to be taken from Austroads design guidelines at detailed design stage and subject to eventual road corridor alignment;
- An alternately surfaced parking shoulder 2.5m on one side. The parking shoulder is proposed as continuous to provide for longer-vehicle parking demands as they are generated by the industrial activity;
- Substantive planted shoulder areas enabling the establishment of larger tree species with the potential for canopy development to contribute to the targeted speed environment;
- Shared paths on both sides of the corridor; and
- Utilities service berm areas.

10.6 Minor Accessway Link to Swayne Road

The key function of this road corridor is to support local road access for light to medium local traffic movement. It enables the local and eastern Cambridge neighbourhood areas to access the site without contributing congestion and delay to the Victoria Road strategic arterial corridor. Larger vehicles will be constrained from movement onto and along the corridor through design features that include:

- Narrower traffic lanes;
- A meander design alignment that also limits the through sight lines and diminishes the attractiveness of the corridor;
- Low radius entry threshold curves;
- Speed management devices on and at the threshold entrances to the link;
- Regulatory signage preventing larger vehicles (greater than a single unit vehicle – 12 tonnes gross) entering the space from either end; and
- Trees established along each edge as well as the central median further contributing to the enclosure and local access managed nature of the link.

The proposed formation is shown on Figure 10-4:

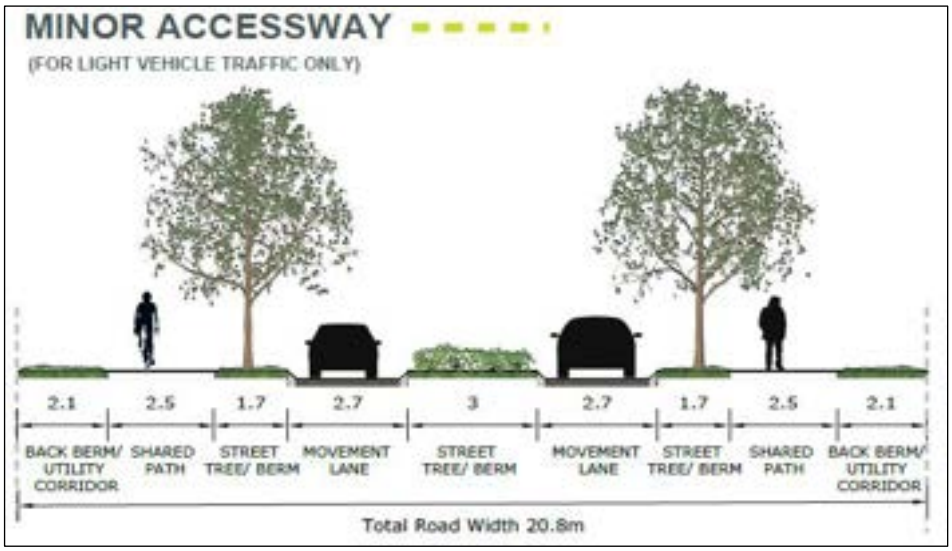

Figure 10-4: Indicative Internal Minor Accessway Link with Swayne Road

Key elements of the cross section can be summarised as follows:

- Two times 2.7m lanes separated by a 3.0m central planted median;
- No parking shoulders, however, a mountable kerb design to support management of the corridor in the event of a breakdown or an incident;
- Substantive planted shoulder areas enabling the establishment of larger tree species with the potential for canopy development to contribute to the targeted speed environment;
- Shared path on one or both sides of the corridor; and

- Utilities service berm areas.

The Urban Designers have advised the central landscaping for the Minor Accessway has a high degree of importance in mitigating views from the rural areas into the industrial area, contributing to the constrained vehicular accessibility intended and in being effective in managing the sight lines through the link appropriately to limit its appearance as anything other than a low speed, low volume, light vehicle access connection. It is a direct response to the landscape and visual effects assessment to ensure appropriate interface along Swayne Road.

10.7 Zig Zag Road and Swayne Road Rural Industrial Local Road

The key function of this local road corridor is to service both community access as well as access to support the plan change. The proposed formation is shown on Figure 10-5:

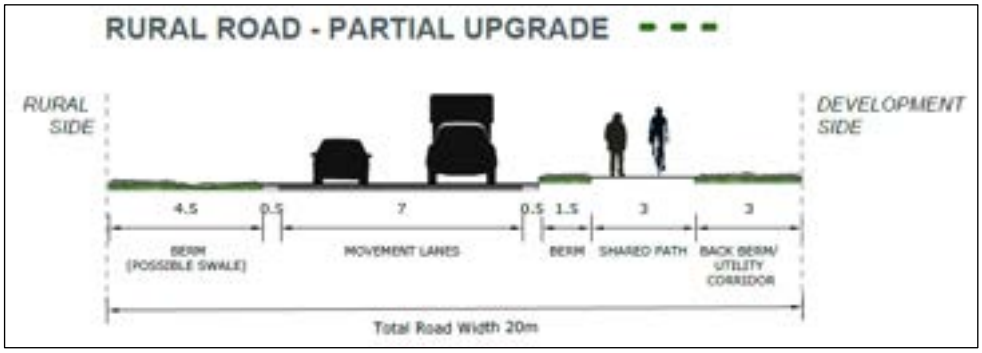

Figure 10-5: Indicative Rural Industrial Local Road

Key elements of the cross section can be summarised as follows:

- A 7.0m carriageway (two 3.5m lanes) with 0.5m sealed shoulder areas;
- Rural grassed berms inclusive of utility service corridor areas; and
- A shared path on the site side of the corridor.

The current stormwater function of these corridors is to be supported, sustained and integrated into the design concept. Detailed stormwater management design anticipates this is sustainable. Where amendments are necessary in future this will be integrated with detailed design at that time.

10.8 Victoria Road Rural Industrial Arterial Road

The key function of this major arterial road corridor is to support inter-regional distribution and efficient movement associated with the wider regional area. It has a key centralised access and movement function in relation to the Hautapu Industrial Growth Cell areas, part of which includes the proposed Structure Plan.

The developed form of the corridor will vary over time and will be significantly influenced by the form of, and the number of lanes established at the key intersections along its length. The corridor is indicatively wide enough to support a future four-lane function. The detailed form of the intersections at Hautapu Road, at the BIL point of entry and the interchanges with the WEX are indicatively described in the analytical modelling

sections. The detailed form to be implemented can be more finely and purposefully developed at the time of implementation. On these bases it is evident the long-term arrangement of the corridor can be established. Nothing within the context of the proposed Structure Plan has been identified as being constrained by the available corridor width. Capacity development works on this corridor have been described and provided for within the infrastructure identified at section 9 of this assessment.

11 Parking, Loading and Servicing On-site

The parking, loading, and servicing provisions for the PC14 area are intended to be established in accordance with the relevant and current provisions of the District Plan. No new or amended provisions are intended.

12 District Plan Assessment

12.1 Objectives and Policies

The following tables set out an assessment of the relevant s.16 Transportation objectives, policies and rules of the District Plan in terms of the plan change proposal.

Table 12-1: District Plan Objective and Policy Assessment

Objective/Policy	Assessment
Objective - Ensuring sustainable, integrated, safe, efficient, and affordable multi-modal land transport system.	
16.3.1 - All new development, subdivision and transport infrastructure shall be designed and developed to contribute to a sustainable, safe integrated, efficient (including energy efficient network design) and affordable multi-modal land transport system.	Supports The roading network within the Structure Plan provides good connectivity to the existing transportation network. In particular it considers connection to existing and planned walking and cycling networks and provides good levels of permeability for these modes.
Policy – Design elements	
16.3.1.1 – Development, subdivision and transport infrastructure shall be designed and located to:	
(a) Minimise energy consumption in construction, maintenance and operation of the network;	Supports The Structure Plan connects to the existing roading network at three points producing and effective local transport network distribution. Alternative transport modes are to be established with safe systems and in locations that are convenient and direct.
(b) Accommodate and encourage alternative modes of transport;	Supports The layout of the Structure Plan includes shared paths, through which people will be able to walk and cycle or eventually take public transport.
(c) Give effective road hierarchy; and	Supports The Structure Plan road network appropriately connects with the existing hierarchy and provides a clear hierarchy within the plan change area.
(d) Contribute to: (i) Integrated transport and land use planning and a safe road system approach; (ii) Reducing deaths and serious injuries on roads; (iii) An effective and efficient road network; and (iv) Efficient movement of freight.	Supports The plan change proposes safe system transport infrastructure and is designed to integrate in an efficient and effective way with the planned transport network beyond the site.
Policy – Ensuring future connections	
16.3.1.2 - Development, subdivision and transport infrastructure shall be designed and located to: (a) Link to existing transportation networks, including roads, walking, cycling and passenger transport; and	Supports The layout of the Structure Plan connects to existing and planned vehicular, cycle and pedestrian networks.

Objective/Policy	Assessment
(b) Accommodate future transport network connections and walking, cycling and passenger transport options to Deferred Zones and future growth areas.	Supports The Structure Plan accommodates walking and cycle facilities and connects these with exiting, adjacent and planned future networks.
Policy – The timing and availability of planned funding for transport infrastructure	
16.3.1.3 – The provision of transport infrastructure for any development or subdivision shall be managed in such a way that it takes into account the timing and availability of planned funding for transport infrastructure.	Supports Currently there are no public transport infrastructure planned for the Structure Plan however the road network has been established to integrate with future use by buses.
Objective – Integrated land use and transport: ensuring a pattern of land uses and a land transport system which is safe, effective, and compatible	
16.3.2 – Land use and transport system successfully interface with each other through attention to design, safety, and amenity	Supports The Plan Change is anticipated and has been designed to align with the anticipated integration in a safe and effective way. A high degree of multi-modal transport infrastructure is proposed.
Policy – Integrated land use and transport	
16.3.2.1 – Development, subdivision and transport infrastructure shall be located, designed, and managed to:	Supports: As follows:
(a) Minimise conflict on and across arterial routes and provide appropriate access;	Supports The plan change integrates with current arterial routes by adopting safe system intersection forms.
(b) Include access that is safe and appropriate for all road users, including those with restricted mobility	Supports Access to the Structure Plan connects to existing networks and provides safe and appropriate access for all road users through existing and planned walking and cycling networks and safe system transport infrastructure.
(c) Minimise the need for travel and transport where practicable; and	Supports The plan change is highly integrated for multi-modal transport movement, safely separated and well-integrated with current and planned networks.
(d) Facilitate travel demand management opportunities where practicable.	Supports The plan change is highly integrated for multi-modal transport movement and public transport systems, safely separated and well-integrated with current and planned networks.
Policy – Enhance pedestrian safety	
16.3.2.2 – To improve pedestrian safety in proximity to schools and other community facilities, and commercial areas including pedestrian frontage areas; the standard of pedestrian networks shall be enhanced to accommodate and encourage greater use.	Supports Safe and appropriate infrastructure together with speed environments have been proposed to ensure this integrated outcome.
Policy – Safe roads	
16.3.2.3 – Development and subdivision design and construction shall contribute to a safe road environment by:	Supports as follows:

Objective/Policy	Assessment
(a) Providing safe and appropriate locations for vehicle entrances, driveways, pedestrian, and cycle routes; and	Supports Multimodal accesses to the Structure Plan connect to the existing networks in locations that are considered to be appropriate. The safe speed environment within the plan changes as well as on the adjoining transport network promotes safe vehicle access and a safe cycle and pedestrian environment.
(b) Designing and locating transport network, lighting, street furniture and landscaping to minimise conflict, maintain visibility, and provide for maintenance activities.	Supports The roads within the plan change area can accommodate amenities that can promote safety within the development.
Policy – Managing effects on character and amenity	
16.3.2.4 – Development, subdivision and transport infrastructure shall be located, designed, and managed to:	Supports as follows:
(a) Avoid, remedy, or mitigate adverse effects of transport on character and amenity;	Supports Appropriately safe, convenient, efficient, and suitable transport infrastructure design amenity has been described and is enabled by the plan change.
(b) Facilitate opportunities to enhance character and amenity; and	Supports A high amenity outcome will be achieved through integration of the extensive stormwater and reserve areas within the overall transport solution.
(c) Ensure that the outcomes sought in the Waipā 2050 Growth Strategy, Town Concept Plan 2010 Plans, and the character Precinct statements in Section 6 – Commercial Zone of this Plan are achieved.	Supports The proposal seeks to activate an identified future Growth Cell and is therefore consistent in its approach.
Objective – Maintaining transport network efficiency	
16.3.3 – To maintain the ability of the network to distribute people and goods safely, efficiently, and effectively.	Supports The plan change adopts an effective and efficient hierarchical transport network integration approach.
Policy – Effects of development or subdivision on the transport network	
16.3.3.1 – Avoid, remedy or mitigate the adverse effects of development or subdivision on the operation and maintenance of the transport network, including from:	Supports as follows:
(a) Traffic generation, load type, or vehicle characteristics;	Supports The plan change proposes an appropriately integrated hierarchical approach and also recommends and provides to effectively manage and control vehicle types, in particular avoiding HCVs on Swayne Road.
(b) The collection and disposal of stormwater; and	Supports Stormwater solutions are shown to be an integrated part of the transport solution. The particulars for stormwater management are addressed by others.
(c) Reverse sensitivity effects where development or subdivision adjoins existing and planned roads.	Supports The plan change has been laid out and access point located to avoid as far as practical and otherwise minimise reverse sensitivity due to traffic. Transport networks are proposed to be internalised within the site to avoid external effects.

Objective/Policy	Assessment
Policy – Location of network facilities	
16.3.3.2 – When significant alterations to existing utilities occur in the road reserve, or new network utilities locate in the road reserve, the network utilities must avoid, remedy, or mitigate impacts on:	Supports as follows:
(a) The operation, renewal and development of the transportation network; and	Supports Well considered and planned transport infrastructure is proposed in response to the demands assessed to be generated. The provision for utilities is appropriately planned and integrated with the transport network cross section environments proposed.
(b) Existing and planned landscaping, tree planting, footpath, lighting, bus bays, intended carparks, and any other amenity enhancements.	Supports The road cross sections enable and indicate extensive provisions for these facilities.
Objective – Provision of vehicle entrance, parking, loading and manoeuvring areas	
16.3.4 – The provision of adequate and well-located vehicle entrances and parking, loading and manoeuvring areas that contribute to both the efficient functioning of the site and the adjacent transport network.	Supports The plan change is laid out to enable well located and safely positioned access, intersections, crossings, and movements. There are safe separations between key intersections and the provisions for safe separations and sight lines are enabled.
Policy – Location of vehicle entrances	
16.3.4.1 – To maintain the safe and efficient functioning of adjoining roads and railways, vehicle entrances to all activities shall be located and formed to achieve safe sight lines and entry and egress from the site. In some locations, adjoining rail lines, State Highways, and the District's Commercial Zones; vehicle entrances will be limited and will require assessment due to the complexity of the roading environment, or the importance of provision of pedestrians.	Supports Safe sight lines from the Structure Plan area to the existing road network are achievable. A safe speed environment within the Structure Plan allows safe sight line where visibility between vehicle, cycle and pedestrian can be maintained.
Policies - Ensuring adequate parking, loading and manoeuvring areas on site	
16.3.4.2 - To maintain the efficient functioning of adjoining roads, all activities shall provide sufficient area on site to accommodate the parking, loading and manoeuvring area requirements of the activity.	Supports The plan change proposes adoption of the District Plan transportation provisions.
16.3.4.3 - Activities that operate at different times and have adjoining sites may be able to share the use of the same parking spaces.	Supports Enabled to be evaluated at the resource consent application stage for specific activities.
16.3.4.4 - Certain activities may be able to demonstrate through the provision of a travel plan, that staff or occupants of the activity can access the activity through alternative means of travel, thus reducing the requirements for carparks.	Supports Enabled to be evaluated at the resource consent application stage for specific activities.
Policy - Cash in lieu of parking in the Commercial Zones	
16.3.4.5 - When a development is unable to meet the car parking requirements of the Plan, due to insufficient site area, or being located	Supports Site areas are significant in area and able to be comprehensively planned at the resource consent stage.

Objective/Policy	Assessment
where it is undesirable to interrupt a road frontage with vehicle entrances; mitigation of the non-provision of car parking could be achieved through a cash contribution in lieu.	
Policy - Encouraging the adaptive re-use of heritage items	
16.3.4.6 - To achieve the adaptive re-use of heritage items, as listed in Appendix N1, a reduction in the requirement for vehicle entrances, and on-site parking, loading and manoeuvring areas can be considered where these cannot practicably be incorporated on-site due to the location of the heritage item on the site and the size of the site.	Supports Any discovery is able to be planned at resource consent stage. On-site heritage matters are specifically addressed by others.
Objective - Minimising adverse effects of the transport network	
16.3.5 - The transport network can have effects on the adjacent environment that must be mitigated through design.	Supports The plan change has comprehensively assessed the transport infrastructure needs to off-set and enable the zoned land uses.
Policy – Natural environment	
16.3.5.1 - Transport infrastructure, including its layout within a development and subdivision, shall be designed and located to avoid, remedy or mitigate adverse effects on the adjacent environment, having regard to stormwater collection, treatment and disposal, earthworks, noise and the landscape areas identified within this Plan and on the Planning Maps.	Supports A comprehensive and integrated approach has been planned to the transport network and the stormwater management systems. This is evident on the Structure Plan and also on the indicative road cross sections incorporating swale and stormwater management areas.
Policy - Noise and vibration	
16.3.5.2 - Noise sensitive activities, adjacent to strategic roads, including State Highways, collector roads in the Rural Zone and Large Lot Residential Zones, and railway lines; will require acoustic attenuation to ensure the continuation of the ability to achieve acoustic privacy.	Supports The hierarchical approach to the transport environment provides for transport noise and vibration to be contained within the environments intended to provide for it. HCV movement is restricted from Swayne Road to enable appropriate outcomes there. Specific impacts are addressed by others.

12.2 Rules

PC14 has been evaluated with respect to the Transportation Rules of the ODP (Section 16.4). The following Table sets out an assessment of PC14 in terms of its potential for alignment with the relevant Transportation rules.

Table 12-2: District Plan Transportation Rule Assessment

Rule	Assessment
Road Hierarchy	
16.4.2.1 All Structure Plans, plan changes, developments, and subdivisions must be consistent with the road hierarchy, as contained in Appendix T5.	Complies The proposed road layout is consistent with the existing hierarchy and provides appropriate level roads to connect with the existing road hierarchy.

Rule	Assessment
16.4.2.2 To maintain the effectiveness of the road hierarchy, a road network must be designed so that a road connects to a road at the same level in the hierarchy, or directly above or below its place in the hierarchy.	Complies The internal road network hierarchy proposed makes appropriate hierarchical connectivity with the wider transport network.
16.4.2.3 To maintain the effectiveness of the road hierarchy, when a site has two road frontages, vehicle access and egress must be from the lesser road type.	Complies The proposal provides for sites to be internally connected with an appropriate road frontage. Site specific assessments will be made at resource consent stage.
Vehicular access to sites in all zones	
16.4.2.4 Every site shall be provided with vehicle access to a formed road that is constructed to a permanent standard. The vehicle access shall be designed to accommodate the demands of all traffic from the activity on that site, taking into account the form and function of the road.	Complies The arrangement of larger sites provides for subdivision development to occur in a way that aligns with this Rule.
Vehicle entrance separation from intersections and other vehicle entrances	
16.4.2.5 The minimum distance of a vehicle entrance (accessway) from an intersection or other entrance shall be as follows: (posted speed limit of 50km/h or 60km/h): 30m from the intersection (on the major road), and 20m from the intersection (on the minor road). Accesses should be less than 4m apart or greater than 11m apart.	Complies The proposed access onto Swayne Road has been located to achieve compliance with the off-set requirements from the established BIP access driveway as well as the residential driveways opposite. Similarly, location of the point of access on Zig Zag Road is able to achieve alignment with the driveway off-set requirements.
Parking, loading and manoeuvring areas	
16.4.2.13 All activities that involve the erection, construction or substantial reconstruction, alteration or addition to a building on any site, or changes the use of any land or building, shall provide parking and loading / unloading for vehicles on the site at the rates specified in Appendix T1.	Complies The proposal intends adoption of the District Plan transportation provisions in these regards and is therefore assessed as being aligned.
16.4.2.14 Where assessment of the number of parking spaces required results in a fractional space being calculated, any fraction less than one-half shall be disregarded, and any fraction greater than or equal to one- half shall be counted as one space.	Complies The plan change proposals enable sites to be subdivided and developed in accordance with this Rule.
16.4.2.15 Vehicle parking, loading / unloading, and manoeuvring areas shall: (a) Not encroach on any yard setback, outdoor living area, vehicle, or bicycle parking spaces; or other loading / unloading areas; and (b) Be designed, formed, and constructed in accordance with Appendix T2 and ensure that the surface of the required area provides a dust free environment; and (c) Provide for the safe and efficient disposal of surface stormwater clear of any adjoining access or road surface in a way that does not result in ponding or scouring; and	Complies The plan change proposals enable sites to be subdivided and developed in accordance with this Rule.

Rule	Assessment
(d) Be constructed to accommodate the anticipated use of the area by all traffic likely to access the site in the zone in which it is located, including construction traffic taking into account pavement, surfacing, demarcation of spaces, aisles and circulation roads; and (e) Be provided on the site on which the building, activity or proposal is located.	
16.4.2.16 The design and layout of sites shall ensure that access to each required vehicle parking, loading and unloading space is directly from the required access or manoeuvring area.	Complies The plan change proposals enable sites to be subdivided and developed in accordance with this Rule.in the resource consent application for that development.
16.4.2.17 Vehicle manoeuvring space, including those spaces located in a garage, and loading and unloading spaces, shall be provided on a site, of a standard adequate to accommodate a 90-percentile car, or a 99-percentile truck, as described in Appendix T2, in order to ensure that all vehicles have the ability to access the adjoining road in a forward direction after no more than a three-point turning manoeuvre on the site.	Complies The plan change proposals enable sites to be subdivided and developed in accordance with this Rule.
16.4.2.18 All required carparks shall be marked or delineated on site, except in the Residential Zone.	Complies The plan change proposals enable sites to be subdivided and developed in accordance with this Rule.
Carpark landscaping and lighting	
16.4.2.21 All carparks must: Provide at least one tree planted for every 5 car parking spaces at a grade of no less than PB95. For the avoidance of doubt, PB95 is equivalent to a tree that is at least 1.5m tall at the time of planting; and Ensure lighting is designed to avoid shading areas or isolating areas of public use.	Complies The plan change proposals enable sites to be subdivided and developed in accordance with this Rule.
Provision of bicycle parking facilities	
16.4.2.22 In areas other than the Rural Zone and Pedestrian Frontages, activities employing more than ten people must provide bicycle parking facilities at a rate of one bicycle park for every ten people employed.	Complies The plan change proposals enable sites to be subdivided and developed in accordance with this Rule.
Provision of an integrated transportation assessment	
16.4.2.23 A Simple or Broad Integrated Transport Assessment (ITA) shall be prepared for activities as required by this rule.	Complies The requirement is able to be applied on a site-by-site basis. This assessment has been prepared to evaluate the wider transport network impacts and align with the Broad ITA requirements in terms of future transport network demands. Assessments are based on a 2041 future.

By way of an overall assessment of the relevant transportation objectives, policies, and rules it can be seen that PC14 and the extent of assessment is expected to enable alignment and or compliance with the relevant transportation provisions of the District Plan. Fundamentally, the Transportation provisions at s16 of the District Plan are proposed to be adopted and to apply in terms of assessments necessitated by subdivision and activity-based resource consent.

13 Conclusions

The descriptions and assessments set out in this report have been prepared in fulfilment of the requirements of the District Plan with respect to PC14. A Structure Plan has been prepared to establish an appropriate structural form for integration of the transport network. It also establishes an appropriate location and effects management outcome for the location of points of access. A comprehensive and well- integrated multi-modal transport system is described, which will enable future establishment of public transport services.

The analytical and evaluative assessments have identified a long-term future transport network considered necessary to support not only PC14 but a system that will appropriately provide for the long term and full development activity outcomes anticipated by the District Plan and the future Growth Cells WDC has identified. The assessments provide some guidance to inform the development of an IWA and describe the extent to which PC14 is expected to contribute to the transport infrastructure needs.

Overall, PC14 is anticipated by the District Plan, through the Growth Cell identification. It has been assessed that the proposal is consistent with and able to appropriately align with the relevant objectives, policies, and rules of the District Plan. The potential long-term effects are assessed as being manageable, with appropriate and timely infrastructure responses.

By way of an overall assessment therefore, it is concluded the transportation provisions of PC14 and the Structure Plan appropriately align with the relevant transportation and land use policy provisions of the District Plan. The potential transportation effects have been described and are able to be accommodated with the identified transportation infrastructure.

Appendices

Appendix A Strategic Transport Planning Policy Summary

A.1 Government Policy Statement – 2024 Draft for Consultation

The recently published draft GPS amends the weighting for key and priority areas from the previous policy direction slightly. The strategic priorities are proposed as follows:

- Maintaining and operating the system: The condition of the existing transport system is efficiently maintained at a level that meets the current and future needs of users.
- Increasing resilience: The transport system is better able to cope with natural and anthropogenic hazards. Reducing emissions transitioning to a lower carbon transport system.
- Safety: Transport is made substantially safer for all.
- Integrated freight system: Well-designed and operated transport corridors and hubs that provide efficient, reliable, resilient, multi-modal, and low-carbon connections to support productive economic activity.
- Sustainable urban and regional development: People can readily and reliably access social, cultural, and economic opportunities through a variety of transport options. Sustainable urban and regional development is focused on increasing housing supply, choice and affordability, and developing resilient and productive towns and cities through effective transport networks that provide a range of low-emission transport options and low congestion.

A.2 Waipā 2050 District Growth Strategy

Waipā 2050 provides direction as to how and where an additional 25,000 people will be accommodated in the Waipā District (between 2017 and 2050), whilst retaining the special features of the District.

In relation to transport, Waipā 2050 recognises "*maintain, develop and enhance efficient transport networks*" as a key District Challenge (Table 5). The consequential matter to consider is implementation of sustainable transport networks. The implementation of Waipā 2050 is enabled primarily by the District Plan, as well as Structure Plans and the WDC's 10-year Plan.

A.3 Future Proof Sub-Regional Growth Strategy

The Future Proof Strategy is a 30-year growth management and implementation plan specific to the Hamilton, Waipā and Waikato sub-region. Future Proof sets out how the area should develop into the future.

In relation to Te Awamutu and transport, the Strategy includes better public transport and improved opportunities for walking and cycling, and increased densities within the existing town boundaries including a range of housing choices and densities.

In relation to residential development generally, Future Proof includes the following relevant principles:

- Promote increased densities in new residential development and more intensive redevelopment of existing urban areas.

- Ensure development is planned to support safe and efficient transport infrastructure, including public transport provision and reduced dependence on motor vehicles.
- Recognise the need for stronger links between land-use and transport in respect of the settlement pattern and ensure capacity is matched with development potential.

A.4 Regional Policy Statements (RPS)

The purpose of the Regional Policy Statement (RPS) is to provide an overview of the how the Waikato Region will manage its natural and physical resources. It describes the issues, policies, and methods to achieve integrated management. The RPS must be given effect to by the District Plan.

The RPS (Policy 6.1) recognises the importance of planned and co-ordinated subdivisions and integrating land use development with transport infrastructure. A key aspect of information required to support new urban development is the demonstration of multi-modal transport connections with the subdivision, to neighbouring areas and to existing transport infrastructure.

A.5 Waikato Regional Land Transport Plan (RLTP) 2021-2051

The Regional Land Transport Plan (RLTP) sets the strategic direction for land transport in the Region. It describes what the region is aiming to achieve for the land transport system and how this will contribute to an effective, efficient, and safe land transport system, as required under the Land Transport Management Act 2003 (LTMA).

The RLTP includes two projects of relevance to Te Awamutu. The Hamilton to Te Awamutu section of SH3 is identified for safer corridor works. The project is number 14 on the list of priority projects.

A.6 Waikato Regional Public Transport Plan (RPTP) 2022-2032

The Waikato Regional Public Transport Plan (RPTP) sets the objectives and policies for public transport in the Waikato region. It outlines a future plan for the public transport network and development plans for the next 10 years (2022-2032).

In relation to Te Awamutu, it includes a vision to implement mass transit start up projects including frequent public transport service between Te Awamutu and Hamilton, in the next 10 years.

A.7 Waipā District WDC Long Term Plan 2021-2031

The LTP sets WDC's direction over the ten-year period (2021-2031). It explains what WDC's activities will be and how they will be funded.

The Plan does not contain any specific transport projects in the vicinity of the site. As expected, the Plan does not include any works to support the T4 Growth Cell, as it identified in WDC's planning as being beyond 2035.

Appendix B Summarised Current Transport Environment Reporting

Source: Plan Change 17 Hautapu Industrial - Appendix D: Transportation Assessment, Section 3: Previous Transportation Assessments

B.1 Previous Transportation Assessments

The subsections that follow summarise the previous traffic and transportation assessments undertaken by others specifically for the Hautapu Industrial area (i.e., including the C8 and C9 Growth Cells), the adjacent C10 Growth Cell, as well as the additional area that is proposed to be rezoned Industrial (i.e., "Area 6"). Reports reviewed include:

- Hautapu Structure Plan Transport Assessment report by Beca, dated 28 February 2017;
- Proposed Plan Change 11 – Bardowie Industrial Precinct Integrated Transport Assessment report by Gray Matter, dated 25 July 2018;
- Hautapu Industrial Zone Master Plan Transportation Analysis report by Harrison Grierson, dated 16 December 2020;
- C8/C9 Present Industrial Transportation Design Report by Gray Matter, dated March 2022; and
- Kama Trust Integrated Transportation Assessment report by CKL, dated 11 August 2022.

B.1.1 Hautapu Structure Plan Transport Assessment – Beca Ltd, 28 February 2017

The assessment by Beca evaluated the full Structure Plan area excluding the now additional Area 6 proposal. The assessment also refers to an earlier 2008 assessment, which has not been sourced for the purposes of these assessments. It is stated as addressing the following:

The Transportation Assessment considers the vehicle and non-vehicle transport requirements for the Structure Plan review and any necessary measures to be delivered as part of the Structure Plan to provide suitable multi-modal access to the site.

The key documented findings are summarised as follows, together with some commentary to reflect any recent changes:

- Transport modelling at the time indicated the impact of the Waikato Expressway link, and its severance of Hannon Road could be expected to reduce traffic volumes on the Structure Plan parts of the road by in the order of 500 – 1,500 vpd;
- A forecast 7,000vpd based on an assumed 71ha development area. Indicatively, 700vph two way in the peak hour. A single collector road was assessed as providing adequate capacity to accommodate the generated traffic demands. The high potential variability of trip generation within a wide industrial land zoning was noted.
- Allwill Drive / Hautapu Road intersection was identified as needing an upgrade to a roundabout, depending on traffic growth in the corridor. Based on an assessed 2 – 3,000vpd at the time, an upgrade was assessed as being needed at about the time demands reached 5,000vpd. Introduction of the upgrade was to be based on WDC's monitoring of the changing demands. Subsequent

access needs for the Fonterra site have indicated traffic signals would be preferred to minimise the land area impact on the internal circulation needs for that site.

- In accordance with the Waipā Subdivision Manual, Allwill Drive was recommended to be formed with two 4m lanes plus parking and shared 2.5m pedestrian/cycle paths each side.
- Hannon Road was recommended to provide initial access with a limit of about 500vpd, or about 5ha of development. Subsequently, it was recommended to be closed at the Hautapu Road intersection. Access to and utilisation of the cemetery land for a roading access option (potentially by way of a roundabout) is described but not determined at this time, the land still being identified as needed for cemetery purposes.
- Access via Peake Road for the plan change was identified as less preferred due to the presence of cyclists and equestrian activity and the current road formation. It was assessed that property access for land fronting Peake Road would be better internalised within the Structure Plan area, which has been adopted.
- The Peake Rd / Hautapu Rd intersection was identified as not being subject to material traffic demand increases and therefore not being identified as necessary for improvement. The predominant access was assessed as being via Victoria Road.
- The internal roading was recommended to be developed to align with WDC's Subdivision Manual and intersection forms were to be determined, noting increased radii for trucks and buses were to be expected.
- A 2.5m wide shared pedestrian/cycle path facility was recommended on the main roads servicing the Structure Plan area. This included an off-road connection with the Hautapu Cambridge cycle trail and linking to the Victoria Road section of the cycle trail as shown on Figure B-13-1. This walking/ cycling connection is included on the current Structure Plan.

Figure B-13-1: Off-road Cycle Trail – Structure Plan Link

B.1.2 Proposed Plan Change 11 (Bardowie Industrial Precinct) Integrated Transport Assessment – Gray Matter, 25 July 2018

The 2018 ITA by Gray Matter assessed the effects on the transport networks associated with private Plan Change 11. PC11, which became operative on 14 March 2019, sought to re-zone approximately 56.7 ha of land (referred to as the "Bardowie Industrial Precinct") located to the east of the Hautapu Structure Plan area to Industrial. The approximately 56.7 ha industrial precinct was identified in the District Plan as being located within the previously named "C8"[17] Growth Cell and was earmarked for future industrial development.

The key documented findings from the ITA that are relevant to this assessment are summarised as follows:

- Once fully developed[18], the Bardowie Industrial Precinct (BIP) was estimated to generate in the order of 12,000 vpd, over an assessed 10-year period. The predicted trip generation was based on a trip generation rate[19] of 20 trips/ha/hr for the peak hour and the assumption that approximately 10% of the average daily traffic is generated during the peak hour (i.e., about 1,200vph).
- It determined a trip distribution of 80% to the south (towards Hamilton/Cambridge and the WEX) and 20% to/from the north (via Victoria Road).
- The projected 2041 peak hour demands for the base network were derived using the WRTM. A key assumption[20] was that the baseline traffic demands excluded the C9 Growth Cell (as this was deferred industrial at the time) and included an equivalent[21] 20 ha of development within the C8 Growth Cell.
- The form of access determined was a staged arrangement comprising a southern access on Victoria Road opposite the southern part of the Hautapu cemetery to service the initial stages of the industrial precinct (identified as Stages 1& 2); and a northern access adjacent to the Hautapu Road/ SH1B Victoria Road/ Laurent Road intersection to provide access for Stage 3 of the precinct. The northern access was identified as the likely future main access to the BIP and the wider C10 Growth Cell.
- The ITA notes the shared use trail located along the now decommissioned rail corridor between SH1B Victoria Road / Laurent Road intersection and Cambridge town, connecting with the urban walking and cycling network on the eastern side of Victoria Road. The ITA states that KiwiRail has indicated they wish to maintain the existing railway designation[22] for a possible future extension of the passenger service between Cambridge and Hamilton.
- The intersection form was ultimately determined to be a single-lane roundabout, with WDC confirming that construction of the roundabout is anticipated to commence in early 2023.
- Provision was made in the BIP Structure Plan for walking and cycling connections, with potential to extend the cycle network from Swayne Road to Victoria Road with a cycle path parallel to the WEX.

[17] The Growth Cell has subsequently been renamed Growth Cell C10.
[18] In a staged manner. Stages 1 & 2 of the BIP involved development of the southern half of the 56.7 ha site over a period of 5 years. Stage 3, which occupies approximately 22.7 ha, was identified as servicing smaller developments rolled out over a period from year 5 into year 10. The remaining 5.2ha of the site is already occupied by Shoof International.
[19] The basis for the trip generation is provided in Section 7.1 of the PC ITA.
[20] PPC11 ITA, Figures 4 and 5
[21] Based on a peak hour trip generation of 20 trips/ha for the approximately 36 ha Growth Cell.
[22] Designation D2 in the District Plan (Cambridge Branch Railway Line – Bruntwood): the operation, maintenance, and improvement of the existing railway

The ITA also notes there being adequate space available within the future internal collector road network to enable public transport infrastructure (bus stops).

Evidence[23] prepared and submitted in support of private PC11 (Growth Cell C10) was reviewed to confirm whether any further conclusions and recommendations were made in relation to the BIP. Relevant findings are summarised below:

- Mr Gray stated[24] that twin roundabouts and a five-leg roundabout were assessed in the Gray Matter ITA as the best options for the northern access at Victoria Road/Hautapu Road intersection. He further stated that both WDC and Waka Kotahi NZ Transport Agency (Waka Kotahi) have expressed preferences for the twin roundabout arrangement due to the rail corridor being least impacted by that arrangement.
- Mr Gray also stated in the same paragraph that both options could be dual-laned if additional capacity is needed in the future, and there are also options for future connections from the BIP to the road network elsewhere to the east and north.

B.1.3 Hautapu Industrial Zone Master Plan Transportation Analysis – Harrison Grierson, 16 December 2020

The brief for the Master Plan assessment by Harrison Grierson Consultants (HG) is stated as comprising a Master Plan for servicing of the Hautapu Industrial Zone (the subject area) located between Victoria Road, Hautapu Road, Peake Road and the WEX. The C10 Growth Cell (more specifically, the "Bardowie Industrial Precinct") was described as not forming part of the scope for the assessment as it was separately considered, staged, and provided for in a previous assessment by Gray Matter.

The following key assessments/findings can be noted:

- Masterplan area (inclusive of the C8 and C9 Growth Cells and excluding "Area 6") comprises an approximately 91ha area, an additional 10 ha to the area identified in the 2017 Beca ITA (refer to Section B.1.1).
- Trip generation demand assessments were made on the basis of a 20 trips/ha/hour (two-way) assumption (which equates to approximately 1,820 vph during the peak hour) and intersection performance assessments were sensitivity assessed based on a higher 40 trips/ha/hour assumption[25].
- Similar to the assessment in the Gray Matter ITA, the base models[26] were developed based on the 2041 WRTM developed for the earlier 2007 AECOM assessment[27]. The 2041 assessment models included the 2041 baseline volumes from the WRTM, as well as traffic associated with the C8/ C9 Growth Cells, the Fonterra site, and the 56.7 ha BIP (i.e., not the entire C10 Growth Cell[28]).

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[23] Statement of Evidence (Traffic) of Mr. A Gray of Gray Matter (dated 19 November 2018) and Statement of Evidence (Planning) of Mr. T Whittaker (dated 22 November 2018)
[24] Statement of Evidence, paragraph 14
[25] For the sensitivity assessment, trip rate figure was applied only to the C8/C9 areas only, not the C10 Growth Cell.
[26] The AM and PM base model flows for the 2041 assessment year are illustrated in Figure 8 and 9 of the HG ITA.
[27] Refer to Section B.1.2 for a review of the WRTM's baseline traffic demand projections.
[28] It is noted that the remaining areas within the C10 growth are described in the District Plan as being earmarked for development "post-2035". Since the assessment year is 2041, it is anticipated that some of the deferred industrial land will likely be developed by 2041. It is recommended that sensitivity testing to

- The underlying transport network assumption in the assessment models included closure of Hannon Road and reformation of a roundabout controlled intersection on Victoria Road. The new roundabout is said to direct the volumes of traffic associated with the C8/C9 area away from the Fonterra access and spread the traffic load across the network. Traffic demands at the Hautapu Rd/ Allwill Drive intersection were identified as being in the order of 5% of the total traffic movement for the C8 and C9 areas.

- Also incorporated as part of the future planned/ committed transport network are the two accesses to the adjacent BIP[29].

- The assessment notes that WDC intends to restrict / minimise industrial traffic on rural roads such as Peake Road; accordingly, no traffic associated with the Structure Plan area has been distributed to Peake Road.

- Shared paths were assessed as appropriate within the Structure Plan area subject to long term demands on their use and the extent to which safe design and management of vehicle crossings is established[30]. These design outcomes are well documented in New Zealand standards and can reasonably be expected to be safely established.

- Public transport outcomes were identified as needing to be provided for longer-term. The proposed internal road cross sections are identified as being wide enough to provide for on street bus stops, and footpaths provided as part of the development would allow for safe and secure connection throughout the C8/C9 areas.

- Several intersection layout options were again considered and assessed for the Victoria Road/ Hautapu Road intersection. The performance of the various options[31], which were assessed using SIDRA Intersection, are summarised below (refer to Table B-1 on the following page for the summarised SIDRA analysis):

    - The priority “Give-Way” control and traffic signal options are unable to deliver the forecast capacity needed.

    - A single large roundabout (i.e., the 5-legged roundabout configuration) is expected to result in high delays and practical capacity being reached at about 2041 in the PM peak.

    - The twin roundabout option demonstrates capacity to meet the expected 2041 demands and indicates some resilience with practical capacity being expected where traffic demands are doubled from the Structure Plan area as indicated in the sensitivity analyses.

- The “twin” roundabout configuration was assessed as operating with the least expected delay when assessed against a range of alternatives. A multi-criterial analysis (MCA) also identified the twin roundabout option as preferred in this location (with a rating of 3.4 out of 5), followed by the double linked signalised intersection (with a rating of 3 out of 5).

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assess the impact of more industrial land being developed within the C10 Growth Cell by the 2041 assessment year.

[29] Based on the SIDRA Intersection summaries provided, the trip generation associated with the BIP has been distributed proportionally between the northern and southern accesses.

[30] Proposals to manage conflict between cyclists and HCVs include implementing surface treatments at driveways to provide visual cues to drivers that cyclists and pedestrians are using the shared path.

[31] Important to note that all the roundabout options assessed are all dual-lane roundabouts

- Regard was also noted in terms of continuing to provide for future rail use within the existing rail corridor. The appropriateness of a two-roundabout (twin) arrangement either side of the rail corridor was identified as an appropriate design response.

Table B-1: Performance Analysis Summary for 2041 Assessment Year: Victoria Rd/ Hautapu Rd Intersection

Intersection Option		AM Peak		PM Peak		Comment
		LOS	Ave Delay (sec)	LOS	Ave Delay (sec)	
Existing: Priority-Controlled	Victoria Road/ Hautapu Road	F	7,500	F	9,800	Both intersections over-capacity
	Victoria Road/ Laurent Road	C	26	F	110	
Single Five-Leg Roundabout		D	38	F	73	Over-capacity
Twin Roundabout	West (Hautapu Road)	A	9	B	14	Acceptable LOS
	East (Laurent Road)	A	7	A	7	
Twin Roundabout Sensitivity	West (Hautapu Road)	E	60	F	346	@ 40 trips/ha for C8/C9. PM peak over-capacity
	East (Laurent Road)	A	8	A	7	
Five-Leg Traffic Signals		F	487	F	648	Over-capacity
Twin Signals	West (Hautapu Road)	F	153	F	197	Victoria Road/ Hautapu Road intersection over-capacity
	East (Laurent Road)	D	36	C	35	

- For the Hautapu Road/ Allwill Drive intersection, the two options identified in the Beca ITA (traffic signals vs a roundabout configuration) were compared and assessed. The performance assessment of the two options, including sensitivity analyses, is summarised below (refer to Table B-2 for a summary of the SIDRA analysis):
    - As shown in Table B-2, both the roundabout and traffic signal options indicate the capacity to function at this location up to 2041. It is, however, noted that the existing priority-controlled configuration also functions adequately up to 2041 (on the basis of a trip generate rate of 20 trips/ha in the peak hour), and was identified as being a potentially more efficient outcome in the interim with an upgrade (to either signals or a roundabout) being able to be introduced at a later stage if needed.
    - While a roundabout is expected to operate more efficiently from a vehicle perspective (identified as the reasonable option in terms of delay performance), the HG ITA described this location as a key pedestrian crossing place and recommended the adoption of the traffic signal option from a road safety perspective for vulnerable road users.
    - Traffic signals were determined to be the preferred intersection control at the intersection in terms of compactness and pedestrian/cycle connectivity.

- The MCA identified a signalised intersection (either 3 or 4-leg) as the preferred configuration, with the 4-leg option performing slightly better[32] than 3-leg option because of the improved safety performance associated with relocating and incorporating the Fonterra access into the intersection. On this basis, the preferred design included the relocation of the Fonterra access to the west to align with Allwill Drive.

- Traffic signals outscored the roundabout options in the MCA due to the associated capital costs and land acquisition costs[33] of constructing a roundabout at this location.

Table B-2: Performance Analysis Summary for 2041 Assessment Year: Hautapu Rd / Allwill Dr Intersection

Intersection Option	AM Peak		PM Peak		Comment
	LOS	Ave Delay (sec)	LOS	Ave Delay (sec)	
With Fonterra Access Excluded (i.e., not relocated to the intersection)					
Existing: Priority-Controlled (3-leg)	A	4	A	5	20 trips/ha/hr. Acceptable LOS.
Single-lane Roundabout (3-leg)	A	6	A	8	20 trips/ha/hr. Acceptable LOS.
Traffic Signals (3-leg)	B	18	C	21	20 trips/ha/hr. Acceptable LOS.
With Fonterra Access relocated to the intersection (forming the fourth leg)					
Existing: Priority-Controlled + Fonterra Access (4-leg)	A	5	B	10	20 trips/ha/hr. Acceptable LOS.
Existing: Priority-Controlled + Fonterra Access (4-leg) **Sensitivity**	A	5	C	22	40 trips/ha/hr. Acceptable LOS. However, right-turn from Allwill Drive @ LOS F in PM peak
Single-lane Roundabout (4-leg) + Fonterra Access	A	6	A	9	20 trips/ha/hr. Acceptable LOS.
Single-lane Roundabout (4-leg) + Fonterra Access **Sensitivity**	A	6	A	9	40 trips/ha/hr. Acceptable LOS.
Traffic Signals (4-leg) + Fonterra Access	C	22	C	33	20 trips/ha/hr. Acceptable LOS.
Traffic Signals (4-leg) + Fonterra Access **Sensitivity**	C	23	D	36	40 trips/ha/hr. Near capacity

By way of confirmation of the conclusions above, the SIDRA modelling files developed by HG were requested and reviewed. It is concluded they are appropriate for informing assessments at this structure planning level of evaluation.

On the basis of these assessments, it can be concluded the recommendations in the HG ITA can be accepted. It is noted the HG ITA does not include an assessment of the proposed rezoning of Area 6. This is assessed further in the following section.

[32] The MCA scored the 4-leg option 3.3 out of 5, and the 3-leg option 3.2 out of 5.
[33] The roundabout options require significant land take from the Fonterra site.

B.1.4 C8/C9 Present Industrial Transportation Design Report – Gray Matter, March 2022

Gray Matter prepared a design report for the planned improvements to Hautapu Road including the Victoria Road Roundabout, the Fonterra site signalisation, widening of the Hautapu Road carriageway and part of Allwill Drive.

Development of the design concept included consultation with potentially directly affected parties, summarised in *Section 3: Consultation* of the Gray Matter design report as including KiwiRail, Fonterra, Hautapu Country Store, Hautapu Welders and Bardowie Investments Ltd.

Design inquiries included geotechnical and utility services investigations. The developed designs prepared cross sections for the relevant road corridors being Victoria Road, Hannon Road, Hautapu Road, and Allwill Drive.

Appendix B to the assessment include a memorandum titled "*Dual lane design – Hautapu/ Victoria Roundabout*". The purpose of the assessment is described as being concerned with changes necessary to support a future dual-laning of the roundabout design. The assessment identified a slightly amended roundabout design to support future dual-laning in the form indicated in the following Figure:

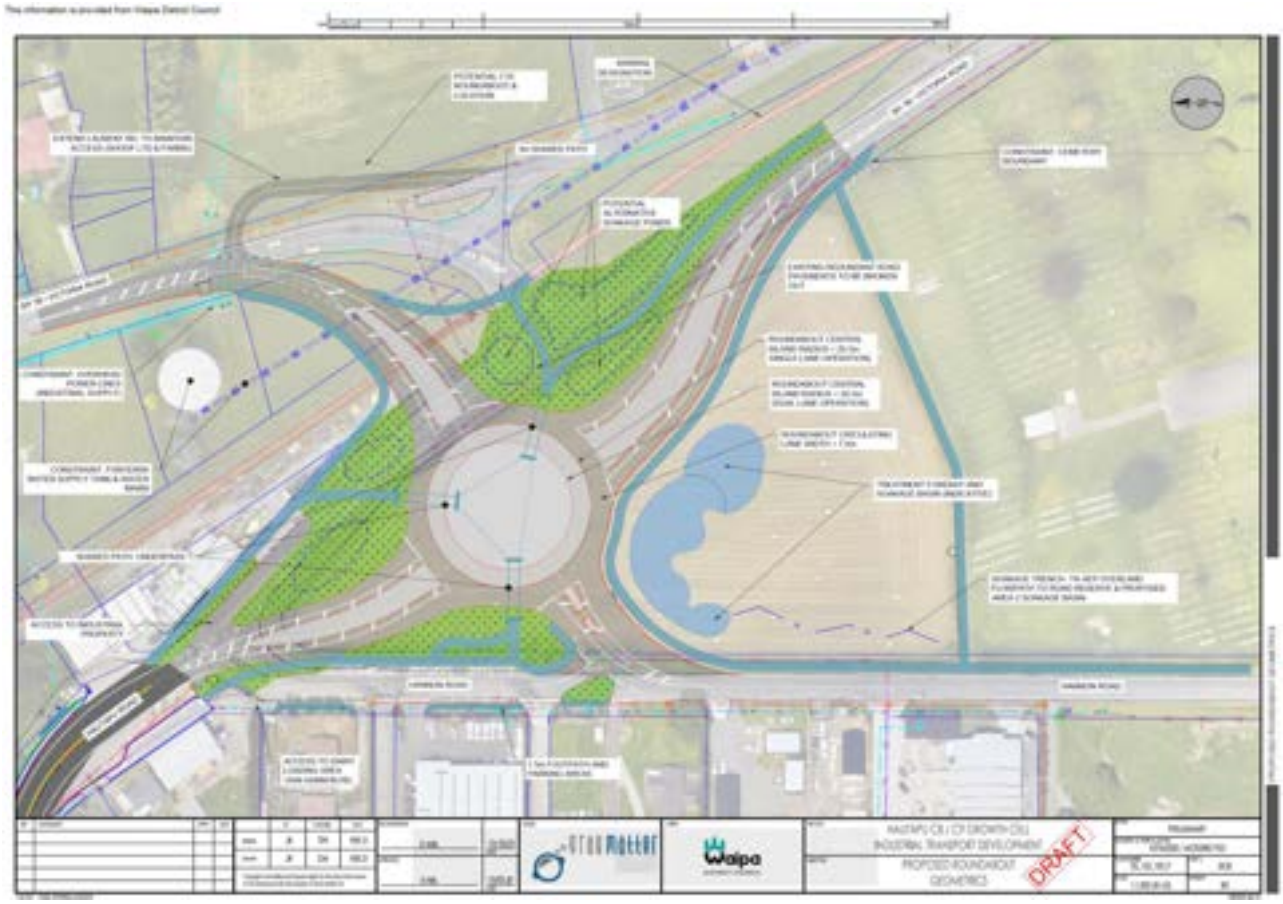


Figure B-13-2: Indicative Future Roundabout Form to Support a Change to Dual Lane Approaches if Required

WDC has advised it does not intend to construct the roundabout wholly in the form shown at this time, however, developed design for the intersection, when that occurs, is intended to facilitate the space necessary to support future dual-laning where that is needed.

The memorandum concluded that the revised concept proved the feasibility *"…to locate a single lane roundabout suitable for conversion to a dual lane arrangement at this site…*[34]". It further concluded requirements with respect to land required, services diversions, local access and Laurent Road requirements and rail corridor design impacts. The assessment signalled a need for the detailed design to focus on development of a safe operating environment.

B.1.5 Kama Trust Integrated Transportation Assessment – CKL, 11 August 2022

The CKL ITA assesses the traffic and transportation effects of rezoning the approximately 20 ha site identified as "Area 6", from Rural to Industrial and including the site within the Hautapu Industrial Structure Plan area.

The following are key findings relevant to this assessment:

- "Area 6" was assessed in the CKL assessment as generating in the order of 398 vph during the typical commuter peak hour based on the trip generation rate of 20 trips/ha/hr, consistent with the HG and previous assessments.
- Access to "Area 6" was identified as being via a new local road (cul-de-sac) with an intersection on Hautapu Road located approximately 230 m east of Peake Road. The future intersection is indicatively designed as a T-intersection with a right-turn bay facility and associated widening on Hautapu Road. Performance analyses using SIDRA Intersection concluded that the proposed intersection form would function adequately up to 2041.
- All trips to/from "Area 6" were assessed as arriving from / departing to the east along Hautapu Road as this was considered as being the shortest route to the state highway network as well as the main urban Cambridge area. WDC had also signalled a desire to limit industrial traffic on Peake Road and other rural roads in the area.
- No access is proposed for properties with frontage onto Peake Road from "Area 6". The assessment considered the Peake Road frontage as being protected from industrial access by Rule 16.4.2.3[35] of the District Plan. Further, the Road and Access text located on the right hand side of the Structure Plan, specifies "No Individual Access To Peake Road".
- Several significant transportation infrastructure upgrades are identified as being committed in the short to medium term. These include the urbanisation works on Hautapu Road (including walking/ cycling facilities on both sides of the road which is expected to connect to the shared path on Victoria Road), and the upgrading of the Hautapu Road/ Allwill Drive and Victoria Road/ Hautapu Road intersections.
- The assessment noted that the earlier HG report evaluated the future Victoria Rd / Hautapu Road intersection as a dual-lane configuration (with additional left-turn slip lanes for the southern and eastern approaches), but through consultation with WDC, a single-lane roundabout design was now being advanced for the intersection in the interim to support wider mode shift outcomes. The referenced designs are illustrated in Figure B-13-3 and Figure B-13-4 below.

[34] Gray Matter Memorandum, 13/04/2021, Dual Lane Design – Hautapu / Victoria Roundabout, S7 Conclusion, page 6

[35] Rule 16.4.2.3 specifies that when a site has two road frontages, vehicle access and egress must be from the lesser road type. The CKL ITA assesses that since Peake Road (a collector road) has a higher classification compared Hautapu Road and the new internal road (both local roads), future access to the site is only permitted from the lower order roads.

Figure B-13-3: Configuration assessed in the HG ITA for the future Victoria Road/ Hautapu Road roundabout

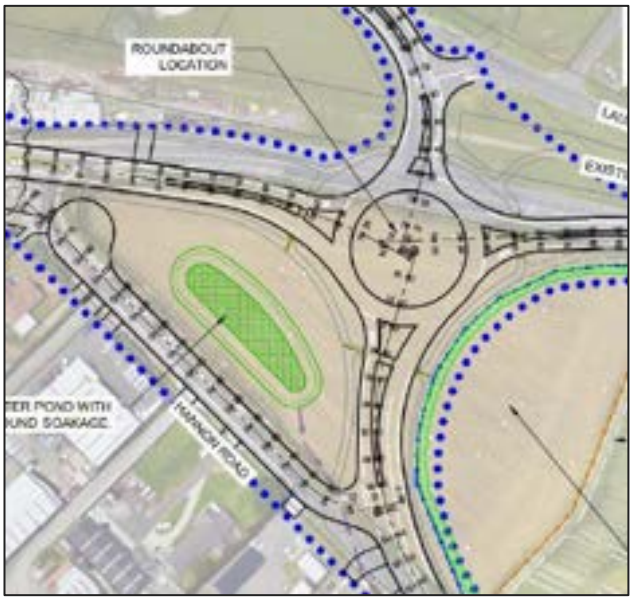


Figure B-13-4: Design being advanced by WDC for the future Victoria Road/ Hautapu Road roundabout

- The performance assessment for the Victoria Road/ Hautapu Road intersection with the additional "Area 6" is summarised as follows:
    - The Victoria Road/ Hautapu Road intersection as a single-lane roundabout using the same input volumes used within the HG ITA. SIDRA analyses undertaken showed that a single-lane roundabout configuration was likely to be significantly congested in the long term for the 2041 baseline scenario (LOS F during both the AM and PM peaks) with excessive queueing on the roundabout approaches and delays exceeding 10 minutes.
    - It concluded that the effect of adding the extra traffic associated with "Area 6" was unlikely to be noticed by road users given that the intersection was already modelled as being well over capacity. The assessment recommended no further upgrades.
    - The CKL assessment states that WDC had accepted that the single-lane roundabout design would likely result in some congestion in the long-term, with WDC confirming an intent to purposefully constrain the network to promote sustainable travel outcomes long-term. The approach is aligned with current transportation policy (the Government Policy Statement – Transport) seeking to reduce reliance on private vehicles and promote public transport, active mode use and reduced vehicle kilometres travelled. WDC has also confirmed that the roundabout is to be designed to enable it to be dual-laned in the future if required from a capacity and safety perspective.
- The performance assessment for the Hautapu Road / Allwill Drive intersection (as a signalised intersection) showed that the intersection performed satisfactorily and would be able to accommodate the future traffic demands (inclusive of the "Area 6" traffic) up to 2041.

Appendix C 2018-23 CAS Data Records

Key CAS data is summarised as follows:

The indicator locations assessed are shown as follows:

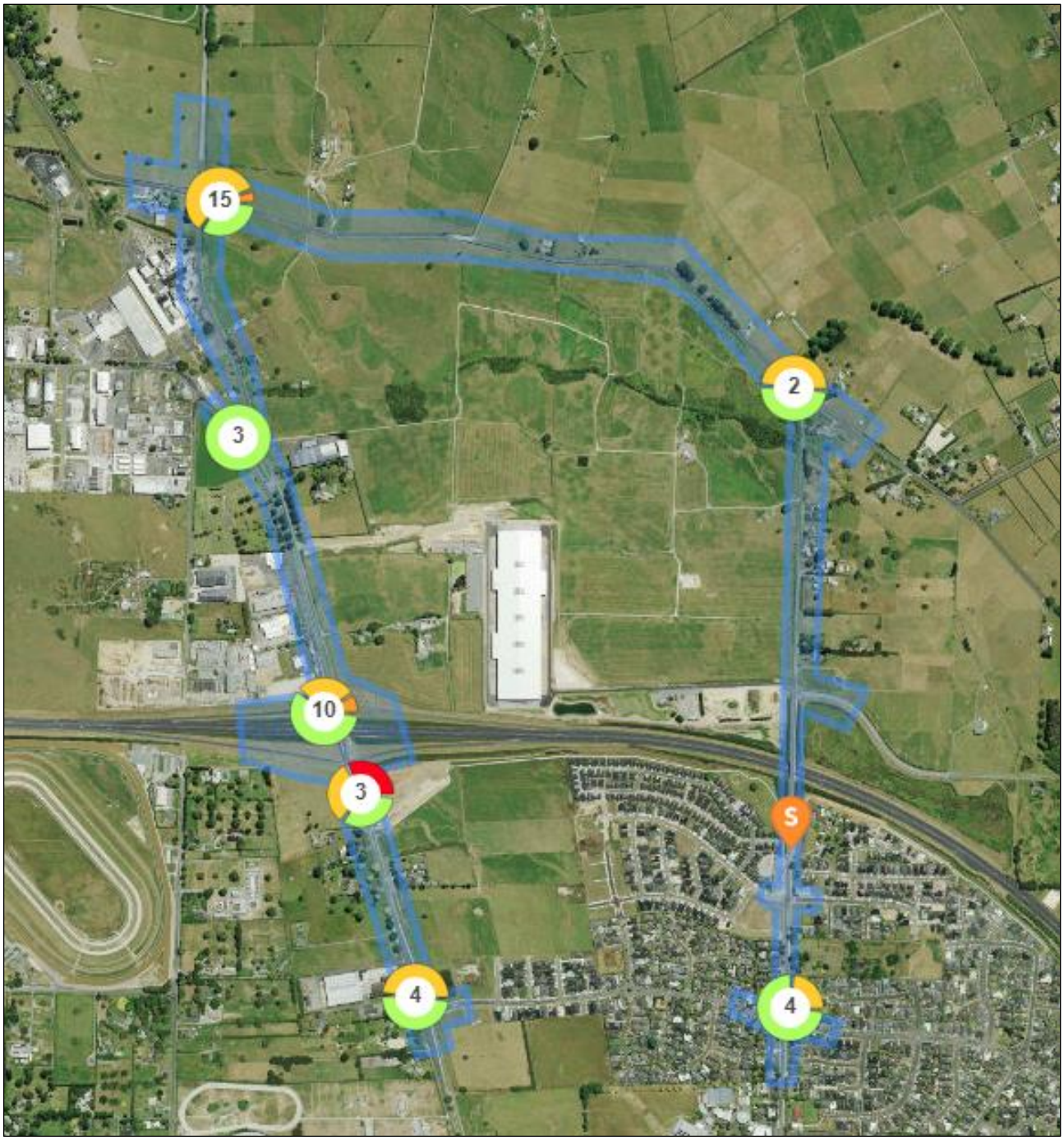


Figure C-1: 2018-22 CAS Data Summary

The descriptive elements of the crash data summarised in the figure above is set out in the following Table:

2018-23 CAS Data Records

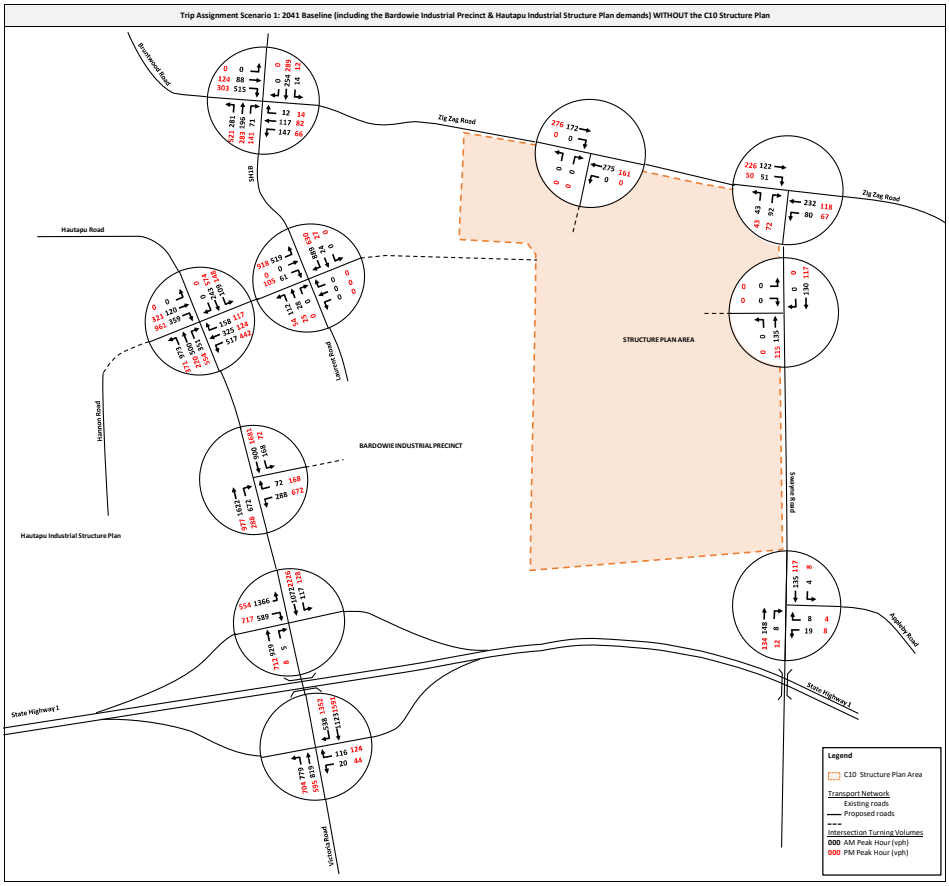
CODED CRASH	Crash road	Distan	Directi	Side road	ID	Date	Day of week	Tim	Description of events	Crash factors	Surface conditi	Natural lig	Weath	Junction	Control	Casualty count fatal	Casualty count serious	Casualty count mino
1289687	NORFOLK DRIVE		I	SWAYNE ROAD	2021193612	24/06/2021	Thu	8:10	Car/Wagon1 WD8 on Norfolk drive hit turning Car/Wagon2	CAR/WAGON1, alcohol test below limit CAR/WAGON2, alcohol test below limit, did not check/notice another party from other dirn, driver dazzled, failed to give way at priority traffic control, ENV: dazzling sun	Dry	Bright sun	Fine	Roundabout	Give way	0	0	0
1158382	SH 1B		I	HAUTAPU ROAD	2018326166	30/01/2018	Tue	13:22	Car/Wagon1 WD8 on SH 1B hit rear end of Car/Wagon2 stop/slow for cross traffic	CAR/WAGON1, failed to notice car slowing, stopping/stationary	Dry	Bright sun	Null	T Junction	Give way	0	0	0
1163715	SH 1B	30	N	VICTORIA ON EBD	2018337974	1/05/2018	Tue	16:18	Van1 SD8 on Victoria Road hit rear end of Van2 stop/slow for queue	VAN1, following too closely, other attention diverted	Dry	Bright sun	Fine	Crossroads	Traffic Signals	0	0	0
1151488	SH 1B		I	BRUNTWOOD ROAD	2018186846	10/08/2018	Fri	6:30	Car/Wagon1 SD8 on Victoria Rd hit Car/Wagon2 crossing at right angle from right, Car/Wagon1 hit non specific fence	CAR/WAGON1, alcohol test below limit CAR/WAGON2, alcohol test below limit, did not stop at stop sign, failed to notice signs	Dry	Twilight	Fine	Crossroads	Stop	0	0	1
1157074	SH 1N	430	E	VICTORIA ON WBD	2018313102	9/08/2018	Tue	11:45	Car/Wagon1 WD8 on Waikato Expressway lost control; went off road to right, Car/Wagon1 hit non specific guard rail	CAR/WAGON1, alcohol test below limit, other attention diverted, too far right	Dry	Bright sun	Fine	Nil (Default)	Unknown	0	0	0
1285099	SWAYNE ROAD	153	N	NORFOLK DRIVE	2021206685	2/12/2021	Thu	14:30	Car/Wagon1 ND8 on SWAYNE ROAD lost control; went off road to left, Car/Wagon1 hit tree	CAR/WAGON1, alcohol test below limit, drugs suspected, sudden action, too far left	Dry	Overcast	Fine	Nil (Default)	Nil	0	0	1
1292964	SWAYNE ROAD	128	N	TERRY CAME DRIVE	2022213279	2/02/2022	Wed	12:05	Cycle1 SD8 on Swayne Road sideswiped by Car/Wagon2 SD8 on Swayne Road turning left	CYCLE1, did not check/notice another party from other dirn CAR/WAGON2, alcohol test below limit, did not check/notice another party behind	Dry	Bright sun	Fine	Driveway	Nil	0	1	0
1319371	SWAYNE ROAD		I	TULIP DRIVE	2022218132	6/04/2022	Wed	19:48	Car/Wagon1 ND8 on Swayne Road hit Car/Wagon2 crossing at right angle from right	CAR/WAGON1, did not check/notice another party from other dirn, failed to give way at priority traffic control	Wet	Dark	Heavy rain	Roundabout	Give way	0	0	0
1291190	TULIP DRIVE	42	E	SWAYNE ROAD	2021193829	7/07/2021	Wed	20:40	Car/Wagon1 WD8 on TULIP DRIVE hit parked veh, Car/Wagon1 hit parked (unattended) vehicle, raised median	CAR/WAGON1, alcohol test above limit or test refused, too far left	Dry	Dark	Fine	Nil (Default)	Nil	0	0	0
1155292	VICTORIA OFFEBD		I	VICTORIA ROAD	2018206672	28/11/2018	Wed	22:02	Car/Wagon1 ED8 on Waikato Expressway hit rear end of Car/Wagon2 stop/slow for signals	CAR/WAGON1, alcohol test below limit, did not check/notice another party from other dirn, failed to notice car slowing, stopping/stationary CAR/WAGON2, alcohol test below limit	Wet	Dark	Light rain	Crossroads	Traffic Signals	0	0	1
1159350	VICTORIA ON WBD	30	W	VICTORIA ROAD	2018335590	18/02/2018	Sun	13:00	Car/Wagon1 WD8 on Victoria Road on ramp lost control; went off road to right, Car/Wagon1 hit non specific guard rail	CAR/WAGON1, sudden illness	Dry	Bright sun	Fine	Nil (Default)	Unknown	0	0	0
1187378	VICTORIA ROAD		I	BRUNTWOOD	2018597910	21/08/2018	Tue	13:00	SUV1 SD8 on VICTORIA ROAD overtaking Ute2	SUV1, too far right	Dry	Overcast	Null	Crossroads	Stop	0	0	0
1203345	VICTORIA ROAD		I	HAUTAPU ROAD	2019368304	22/05/2019	Wed	7:22	Ute1 SD8 on VICTORIA ROAD hit rear end of Ute2 stop/slow for cross traffic	UTE1, alcohol test below limit, failed to notice car slowing, stopping/stationary	Dry	Overcast	Fine	T Junction	Give way	0	0	0
1209141	VICTORIA ROAD		I	NORFOLK DRIVE	2019373929	11/07/2019	Thu	0:00	Car/Wagon1 DIRN on VICTORIA ROAD hit Car/Wagon2 turning right onto AXROAD from the left	CAR/WAGON2, did not check/notice another party from other dirn, failed to give way to traffic crossing from right	Null	Unknown	Null	T Junction	Nil	0	0	0
1220796	VICTORIA ROAD		I	ZIG ZAG ROAD	2019183377	18/10/2019	Fri	9:17	Car/Wagon1 ND8 on Victoria Road hit rear of SUV2 ND8 on Victoria Road turning right from centre line	SUV2, alcohol test below limit CAR/WAGON1, alcohol test below limit, attention diverted by other traffic, failed to notice car slowing, stopping/stationary	Dry	Overcast	Fine	Crossroads	Stop	0	0	0
1213131	VICTORIA ROAD		I	ZIG ZAG ROAD	2019177790	18/12/2019	Wed	17:10	SUV1 ND8 on VICTORIA ROAD hit Car/Wagon2 crossing at right angle from right	CAR/WAGON2, alcohol test below limit, failed to give way at priority traffic control, overseas/migrant driver fail to adjust to nz roads SUV1, alcohol test below limit	Wet	Overcast	Light rain	Crossroads	Stop	0	0	1
1215945	VICTORIA ROAD		I	ZIG ZAG ROAD	2020142760	17/01/2020	Fri	12:10	Ute1 ND8 on SH 1B, PUKEMOREMORE, WAIPA hit Car/Wagon2 crossing at right angle from right	CAR/WAGON2, alcohol test below limit, did not check/notice another party from other dirn, failed to give way at priority traffic control UTE1, alcohol test below limit	Dry	Bright sun	Fine	Crossroads	Stop	0	0	1
1230071	VICTORIA ROAD		I	HAUTAPU ROAD	2020145519	5/02/2020	Wed	18:27	Car/Wagon1 WD8 on Victoria Road hit rear end of Car/Wagon2 stop/slow for cross traffic	CAR/WAGON1, alcohol test below limit, failed to notice car slowing, stopping/stationary CAR/WAGON2, alcohol test below limit	Dry	Bright sun	Fine	T Junction	Give way	0	0	0
1243539	VICTORIA ROAD	40	N	LAURENT ROAD	2020164229	16/09/2020	Wed	21:30	Ute1 SD8 on VICTORIA ROAD hit Car/Wagon2 head on on straight	CAR/WAGON2, alcohol test below limit UTE1, alcohol test below limit, too far right	Dry	Dark	Fine	Nil (Default)	Nil	1	0	2
1259804	VICTORIA ROAD		I	NORFOLK DRIVE	2020167698	20/10/2020	Tue	11:15	Ute1 SD8 on VICTORIA ROAD hit rear end of Ute2 stop/slow for signals	UTE1, alcohol test below limit, failed to notice car slowing, stopping/stationary, following too closely UTE2, alcohol test below limit	Wet	Overcast	Light rain	T Junction	Traffic Signals	0	0	0
1247143	VICTORIA ROAD	85	N	BRUNTWOOD ROAD	2020169090	8/11/2020	Sun	11:30	Car/Wagon1 ND8 on VICTORIA ROAD, PUKEMOREMORE, WAIPA hit rear end of Car/Wagon2 stop/slow for obstruction	CAR/WAGON2, alcohol test above limit or test refused CAR/WAGON1, alcohol test above limit or test refused, failed to notice car slowing, stopping/stationary	Dry	Overcast	Fine	Nil (Default)	Unknown	0	0	1
1258679	VICTORIA ROAD		I	ZIG ZAG ROAD	2021186238	29/04/2021	Thu	19:34	SUV2 turning right hit by oncoming Car/Wagon1 SD8 on VICTORIA ROAD	CAR/WAGON1, alcohol test below limit SUV2, alcohol test below limit, did not check/notice another party from other dirn, failed to give way turning to non-turning traffic	Dry	Dark	Fine	Crossroads	Stop	0	0	1
1301909	VICTORIA ROAD		I	VICTORIA ROAD OFF RAMP	2021205645	20/11/2021	Sat	23:40	Car/Wagon1 SD8 on VICTORIA ROAD lost control; went off road to left, Car/Wagon1 hit traffic island, traffic sign	CAR/WAGON1, alcohol test above limit or test refused, other fatigue, too far left	Dry	Dark	Fine	Multislip	Traffic Signals	0	0	0
1307189	VICTORIA ROAD		I	VICTORIA ROAD OFF RAMP	2022222803	16/05/2022	Mon	15:45	Ute1 ND8 on VICTORIA ROAD hit Car/Wagon2 turning right onto AXROAD from the left	CAR/WAGON2, alcohol test below limit UTE1, alcohol test above limit or test refused, did not stop at steady red light, speed approaching a traffic control	Dry	Overcast	Fine	Crossroads	Traffic Signals	0	0	1
1315996	VICTORIA ROAD	175	N	NORFOLK DRIVE	2022229758	29/06/2022	Wed	16:26	Car/Wagon1 SD8 on VICTORIA ROAD lost control on straight and hit Car/Wagon2 head on	CAR/WAGON2, alcohol test below limit CAR/WAGON1, alcohol test below limit, other lost control	Wet	Overcast	Light rain	Nil (Default)	Nil	0	0	1
1320062	VICTORIA ROAD		I	ZIG ZAG ROAD	2022233972	18/08/2022	Thu	18:00	Ute1 ND8 on VICTORIA ROAD hit rear of SUV2 ND8 on VICTORIA ROAD turning right from centre line	SUV2, alcohol test below limit UTE1, alcohol test below limit, failed to notice car slowing, stopping/stationary, other inattentive CAR/WAGON1, alcohol test below limit	Wet	Dark	Light rain	Crossroads	Give way	0	0	3
1339425	VICTORIA ROAD		I	VICTORIA ROAD ON RAMP	2022234122	23/08/2022	Tue	8:50	Ute1 SD8 on VICTORIA ROAD hit rear end of Car/Wagon2 stop/slow for signals	UTE1, alcohol test below limit, failed to notice car slowing, stopping/stationary, speed approaching a traffic control CAR/WAGON2, alcohol test below limit	Dry	Bright sun	Fine	Crossroads	Traffic Signals	0	0	0
1321335	VICTORIA ROAD		I	ZIG ZAG ROAD	2022235035	7/09/2022	Wed	23:36	Car/Wagon1 ND8 on VICTORIA ROAD hit Car/Wagon2 crossing at right angle from right	CAR/WAGON2, alcohol test below limit, did not stop at stop sign CAR/WAGON1, alcohol test below limit	Dry	Dark	Fine	Crossroads	Stop	0	0	2
1321943	VICTORIA ROAD		I	NORFOLK DRIVE	2022235475	10/09/2022	Sat	0:05	Car/Wagon2 turning right hit by oncoming Car/Wagon1 SD8 on VICTORIA ROAD	CAR/WAGON2, alcohol test above limit or test refused, did not stop at steady red light CAR/WAGON1, alcohol test below limit	Wet	Twilight	Light rain	T Junction	Traffic Signals	0	0	1
1321738	VICTORIA ROAD	105	S	ZIG ZAG ROAD	2022235306	14/09/2022	Wed	19:15	Car/Wagon1 ND8 on VICTORIA ROAD hit Car/Wagon2 turning right onto AXROAD from the left	CAR/WAGON1, alcohol test below limit CAR/WAGON2, alcohol test below limit, failed to give way entering roadway from driveway	Dry	Dark	Fine	Driveway	Nil	0	0	1
1326804	VICTORIA ROAD		I	BRUNTWOOD ROAD	2022239556	5/11/2022	Sat	16:54	Car/Wagon1 SD8 on VICTORIA ROAD hit Car/Wagon2 crossing at right angle from right	CAR/WAGON1, alcohol test below limit CAR/WAGON2, alcohol test below limit, did not stop at stop sign	Dry	Bright sun	Fine	Crossroads	Stop	0	0	2
1330013	VICTORIA ROAD		I	VICTORIA ROAD OFF RAMP	2022242382	27/11/2022	Sun	16:30	Ute1 ND8 on VICTORIA ROAD hit Car/Wagon2 turning right onto AXROAD from the left	UTE1, alcohol test below limit, did not stop at steady red light CAR/WAGON2, alcohol test below limit, ENV: heavy rain	Wet	Overcast	Heavy rain	Crossroads	Traffic Signals	0	0	1
1212918	VICTORIA ROAD OFF RAMP		I	VICTORIA ROAD	2019177593	12/08/2019	Mon	22:00	Car/Wagon1 ED8 on VICTORIA ROAD OFF RAMP hit Car/Wagon2 crossing at right angle from right	CAR/WAGON1, did not stop at steady red light	Wet	Dark	Light rain	Crossroads	Traffic Signals	0	0	0
1245980	VICTORIA ROAD OFF RAMP		I	VICTORIA ROAD	2020167195	9/10/2020	Fri	20:17	Van1 ED8 on VICTORIA ROAD OFF RAMP hit rear end of Ute2 stop/slow for signals	UTE2, alcohol test below limit VAN1, alcohol test above limit or test refused, following too closely, speed approaching a traffic control	Dry	Dark	Fine	Crossroads	Traffic Signals	0	1	1
1349699	VICTORIA ROAD OFF RAMP	89	W	VICTORIA ROAD	2022240956	11/11/2022	Fri	17:04	Car/Wagon1 ED8 on VICTORIA ROAD OFF RAMP hit rear end of SUV2 stop/slow for queue	CAR/WAGON1, alcohol test below limit, failed to notice car slowing, stopping/stationary SUV2, alcohol test below limit	Dry	Overcast	Fine	Nil (Default)	Nil	0	0	0
1328559	VICTORIA ROAD OFF RAMP		I	VICTORIA ROAD	2022240781	20/11/2022	Sun	11:10	Car/Wagon1 SD8 on VICTORIA ROAD hit Car/Wagon2 turning right onto AXROAD from the left	CAR/WAGON1, did not stop at steady red light	Wet	Overcast	Fine	Crossroads	Traffic Signals	0	0	1
1209850	ZIG ZAG RD	357	E	VICTORIA ROAD	2019174628	18/07/2019	Thu	8:23	Car/Wagon1 WD8 on ZIG ZAG ROAD lost control turning right; went off road to left, Car/Wagon1 hit fence	CAR/WAGON1, alcohol test below limit, lost control avoiding another party, new driver/under instruction	Wet	Overcast	Fine	Nil (Default)	Unknown	0	0	0
1192805	ZIG ZAG ROAD		I	VICTORIA ROAD	2018101533	14/12/2018	Fri	1:30	Car/Wagon1 WD8 on ZIG ZAG ROAD lost control turning right; went off road to left, Car/Wagon1 hit ditch	CAR/WAGON1, alcohol test above limit or test refused, new driver/under instruction	Wet	Dark	Light rain	Crossroads	Stop	0	0	0
1249378	ZIG ZAG ROAD	63	W	SWAYNE ROAD	2020173006	9/12/2020	Wed	15:25	Car/Wagon1 ED8 on ZIG ZAG ROAD lost control turning left; went off road to right, Car/Wagon1 hit fence, power pole	CAR/WAGON1, alcohol test below limit, swung wide on bend	Dry	Bright sun	Fine	Nil (Default)	Nil	0	0	2
1300512	ZIG ZAG ROAD	348	E	VICTORIA ROAD	2021217722	25/06/2021	Fri	18:00	Car/Wagon1 ED8 on ZIG ZAG ROAD lost control turning left; went off road to right, Car/Wagon1 hit fence	CAR/WAGON1, lost control when turning	Wet	Dark	Light rain	Nil (Default)	Nil	0	0	0
1301550	ZIG ZAG ROAD		I	SWAYNE ROAD	2021205989	17/11/2021	Wed	5:30	Car/Wagon1 SD8 on ZIG ZAG ROAD lost control turning right; went off road to left, Car/Wagon1 hit ditch	CAR/WAGON1, alcohol test below limit, inappropriate speed for road conditions, lost control when turning, ENV: slippery road due to rain	Wet	Dark	Light rain	T Junction	Give way	0	0	0
1338826	ZIG ZAG ROAD	66	E	VICTORIA ROAD	2023251515	4/08/2023	Sat	17:40	Motorcycle1 ED8 on ZIG ZAG ROAD lost control; went off road to right	MOTORCYCLE1, alcohol suspected, lost control - road conditions, new driver/under instruction, ENV: surface bleeding/defective	Wet	Overcast	Light rain	Nil (Default)	Nil	0	1	0

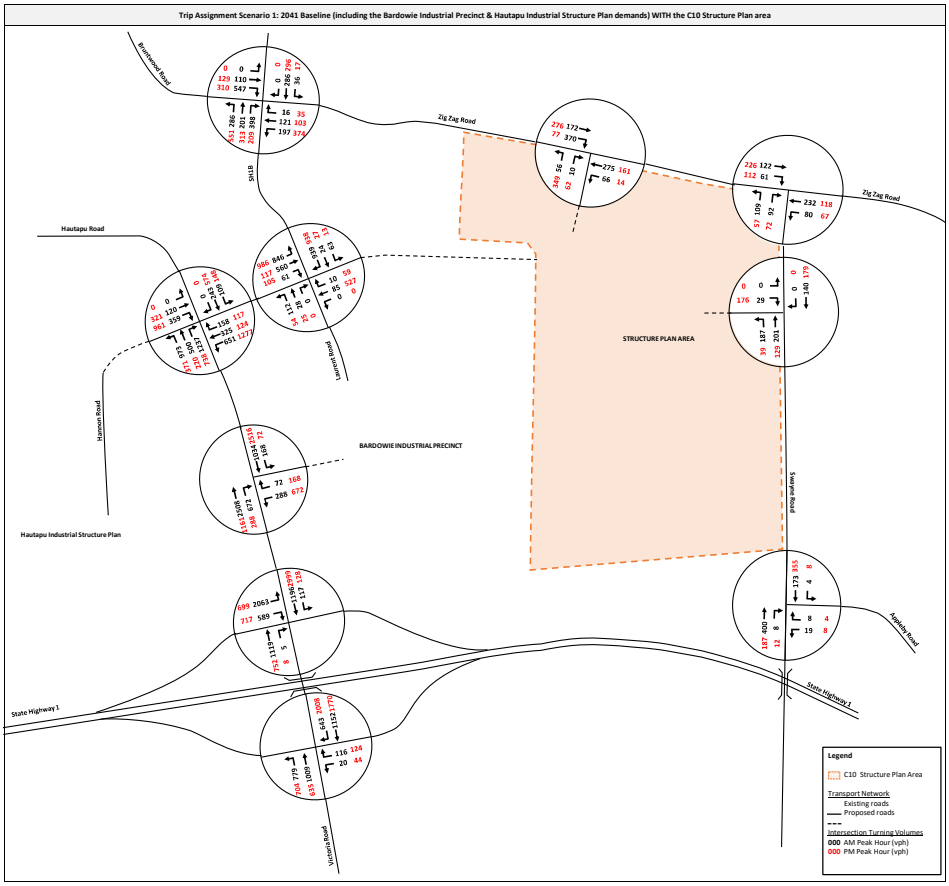
Appendix D Transport Network Resilience Evaluation Scenarios

Assessment Scenarios

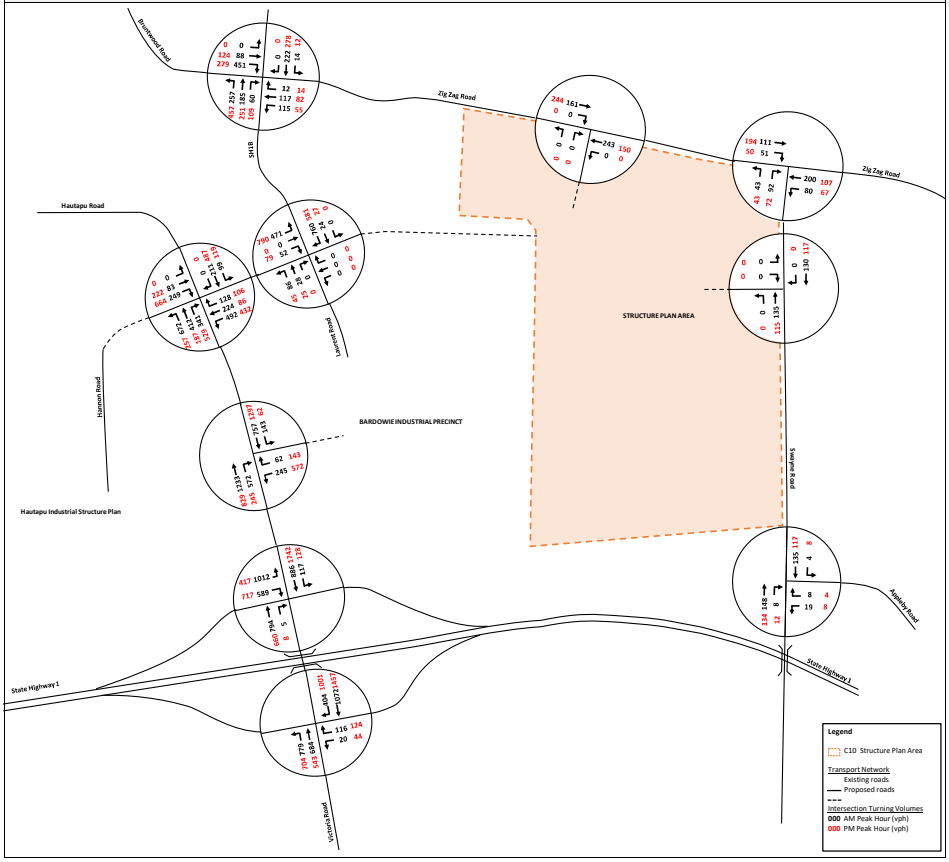
		% Trips dstributed to access									
		C10/ Fonterra Site				Bardowie Industrial Precinct			Hautapu Industrial Structure Plan		
Scenario No.	Access Arrangement	To/ from Dogbone Roundabout	To/ from Southern Roundabout	To/from proposed Zig Zag Road Access	To/ from proposed Swayne Road Access	To/ from Southern Roundabout	To/ from Dogbone Roundabout	To/ from existing Swayne Road Access	To/ from Hannon Road	To/ from Hautapu Road	To/ from Peake Road
Scenario 1	- No direct connection between the Fonterra site and the BIP; - Access to C10/ Fonterra site as follows: = The area south of the Mangaone Stream (approx. 47.4 ha): via the dogbone roundabout and Swayne Road; and = The area north of the Mangaone Stream (approx. 24 ha): via Zig Zag Road; - Access to the BIP (Stages 1 to 3 and existing Schoof development) via southern roundabout. - 100% of Hautapu Industrial Structure Plan traffic distributed east to Victoria Road/ dogbone roundabout.	40%	0%	35%	25%	75%	0%	25%	65%	15%	20%
Scenario 2	- No direct connection between the Fonterra site and the BIP; - Access to C10/ Fonterra site via dogbone roundabout and Swayne Road (i.e., no connection to Zig Zag Road); - Access to the BIP (Stages 1 to 3 and existing Schoof development) via southern roundabout. - 100% of Hautapu Industrial Structure Plan traffic distributed east to Victoria Road/ dogbone roundabout.	75%	0%	0%	25%	75%	0%	25%	65%	15%	20%
Scenario 3	- Internal connection between the C10 growth cell/Fonterra site and the BIP; - Access to C10/ Fonterra site via dogbone roundabout, Zig Zag Road and Swayne Road; - Access to the BIP as follows (as per original Gray Matter assessment): = Stage 1, 2 and existing Schoof development (approx. 34ha) via southern roundabout, and = Stage 3 (approx. 22.7 ha) via dogbone roundabout. - 100% of Hautapu Industrial Structure Plan traffic distributed east to Victoria Road/ dogbone roundabout.	40%	0%	35%	25%	45%	30%	25%	65%	15%	20%
Scenario 4	- Internal connection between the C10 growth cell/Fonterra site and the BIP; - Access to C10/ Fonterra site via dogbone roundabout and Swayne Road (i.e., no connection to Zig Zag Road); - Access to the BIP as follows (as per original Gray Matter assessment): = Stage 1, 2 and existing Schoof development (approx. 34ha) via southern roundabout, and = Stage 3 (approx. 22.7 ha) via dogbone roundabout. - 100% of Hautapu Industrial Structure Plan traffic distributed east to Victoria Road/ dogbone roundabout.	75%	0%	0%	25%	45%	30%	25%	65%	15%	20%

Appendix E Transport Network Resilience Distribution Results

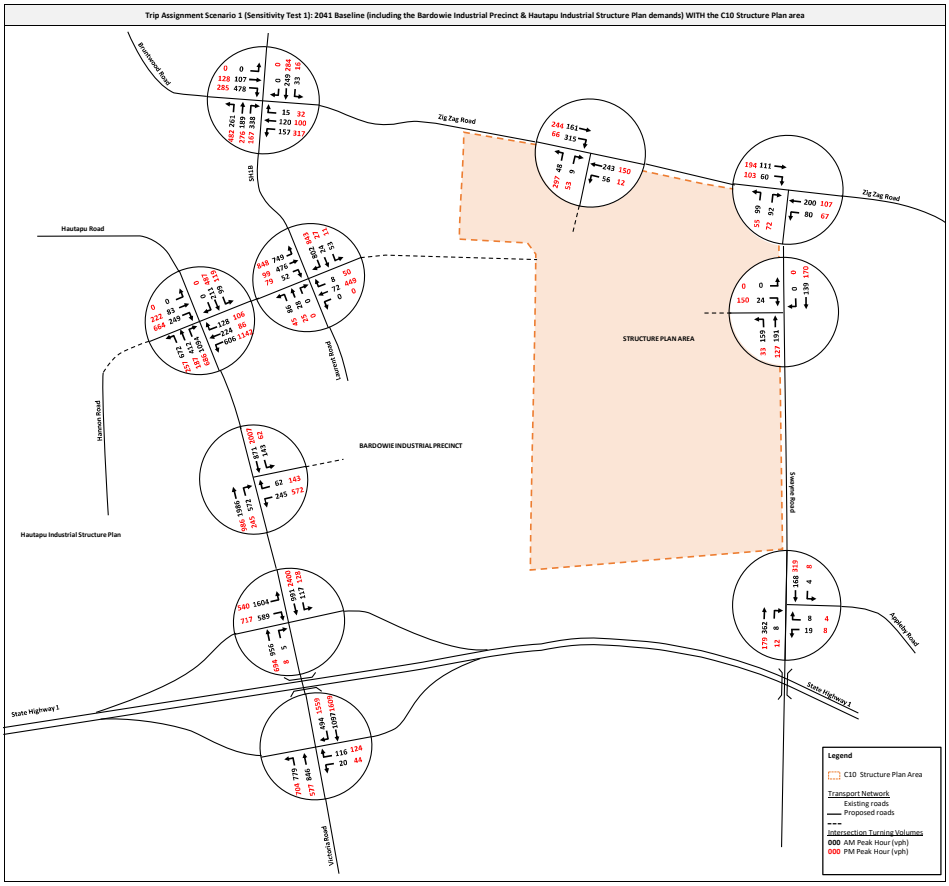


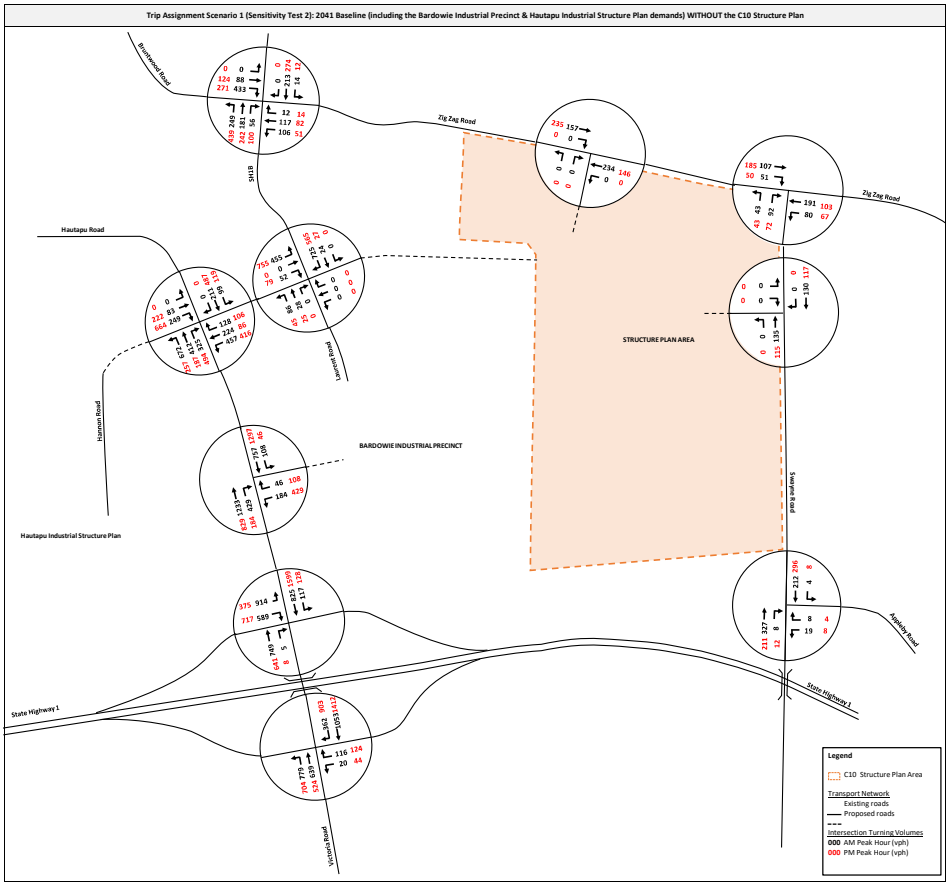


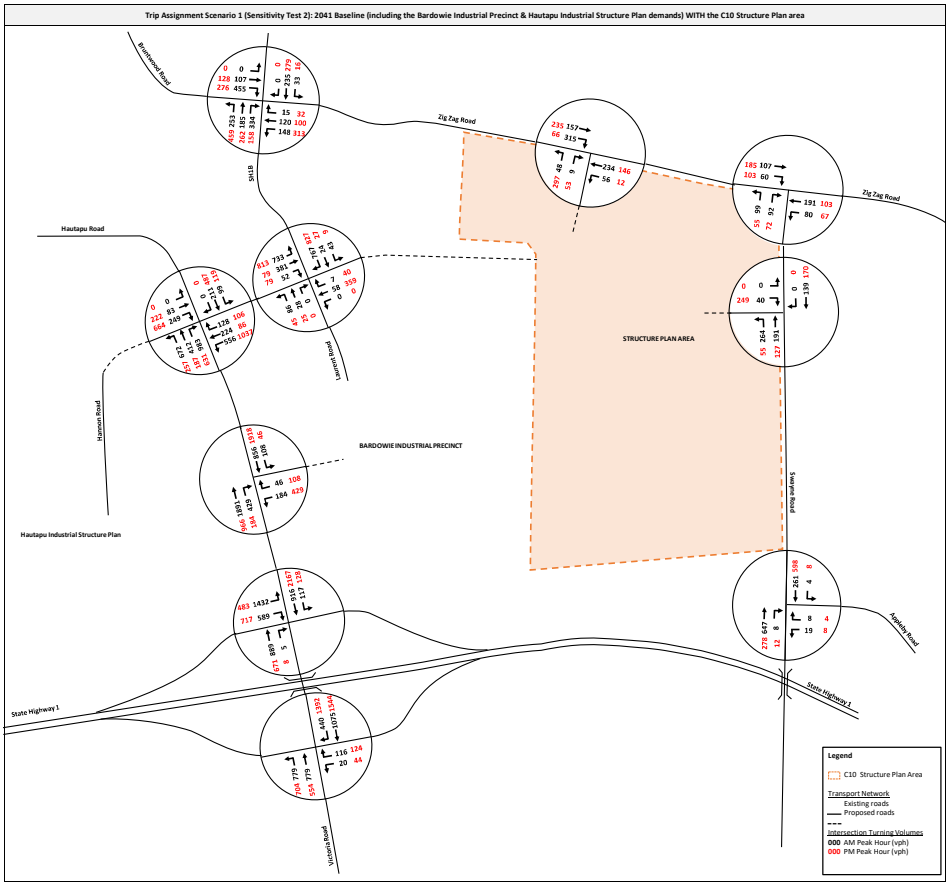
Trip Assignment Scenario 1 (Sensitivity Test 1): 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITHOUT the C10 Structure Plan

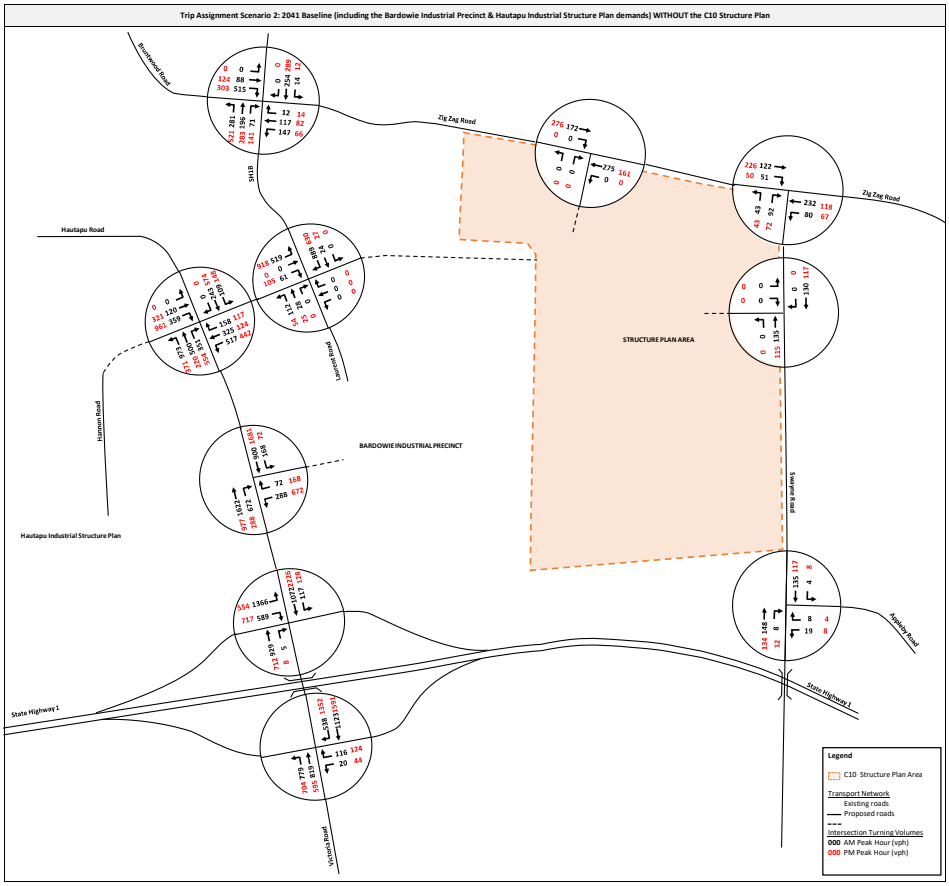


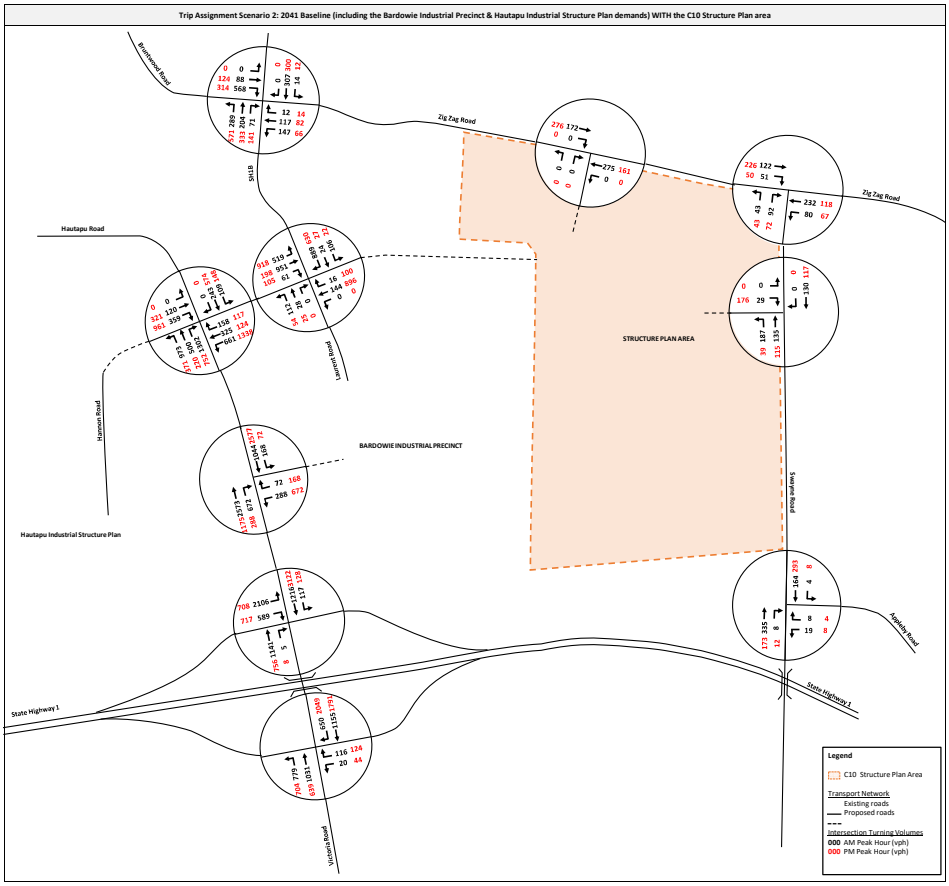
Trip Assignment Scenario 1 (Sensitivity Test 1): 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITH the C10 Structure Plan area



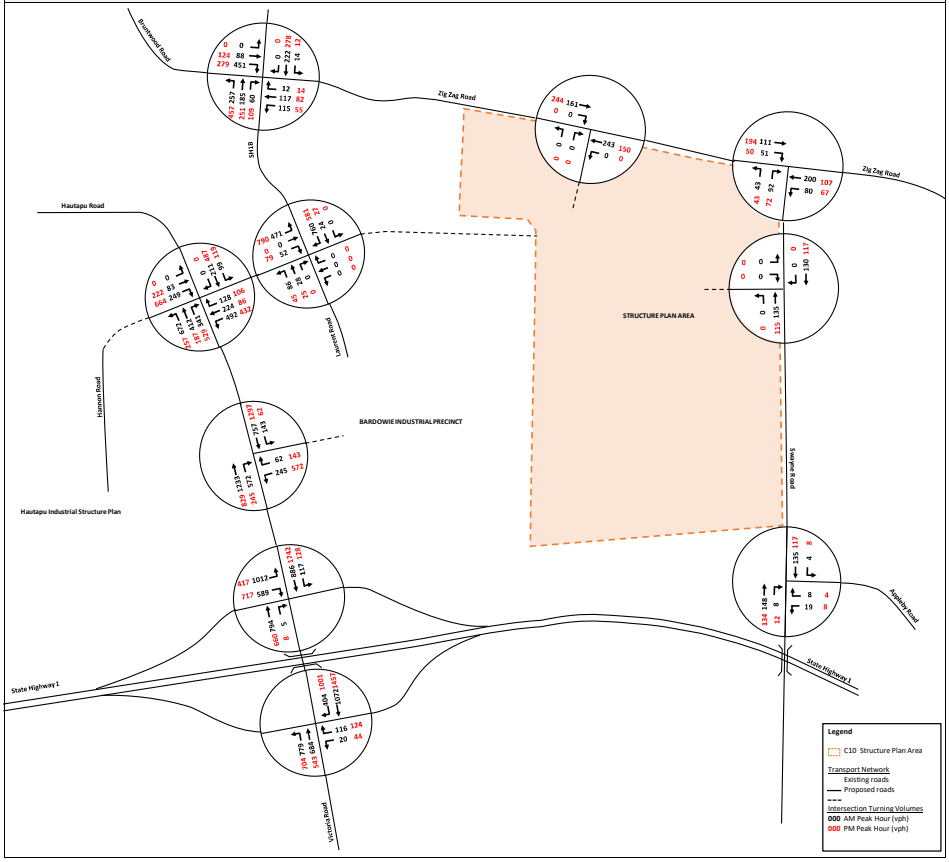




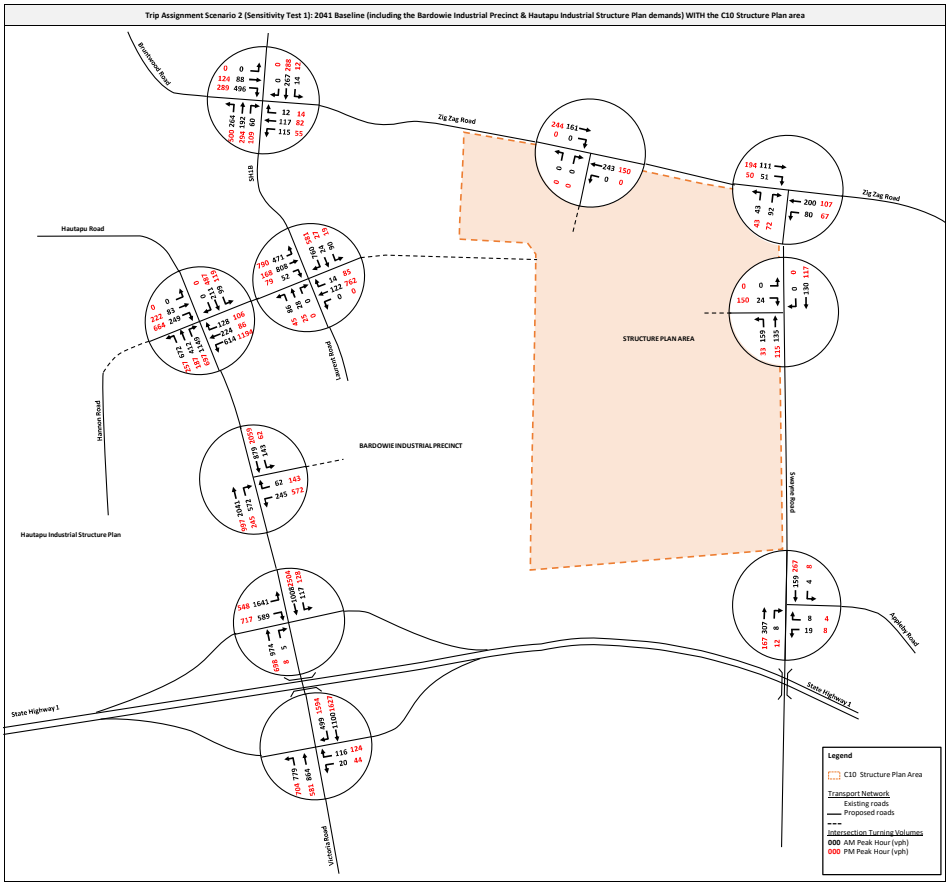


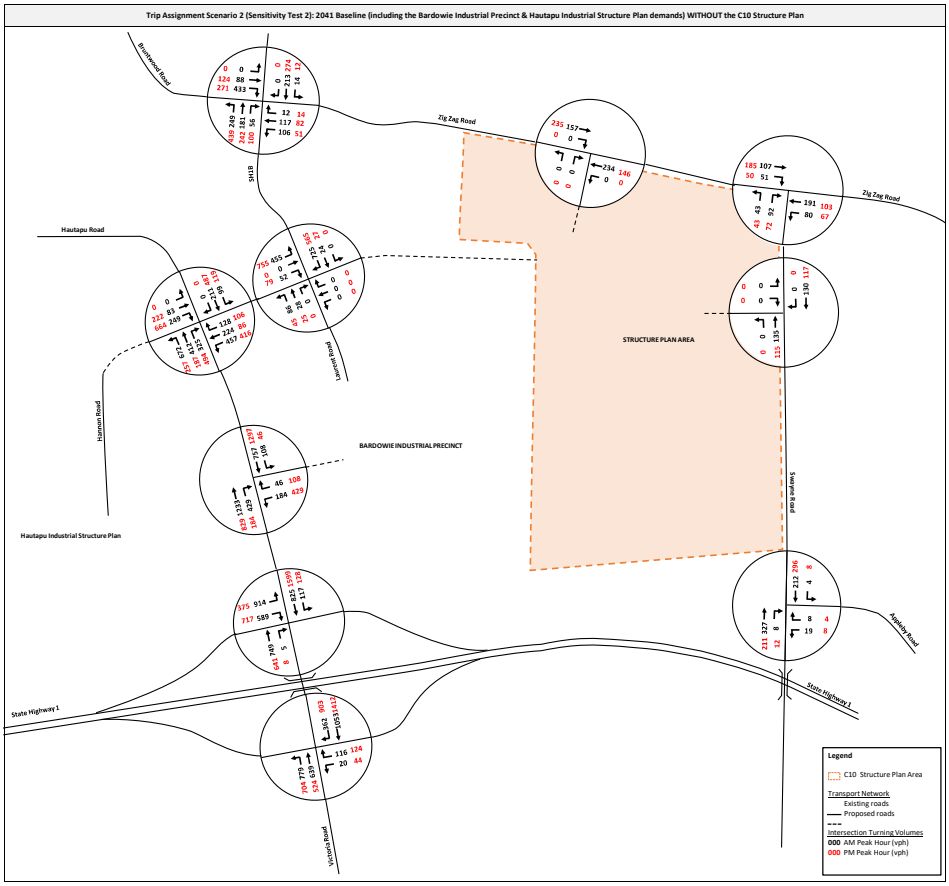


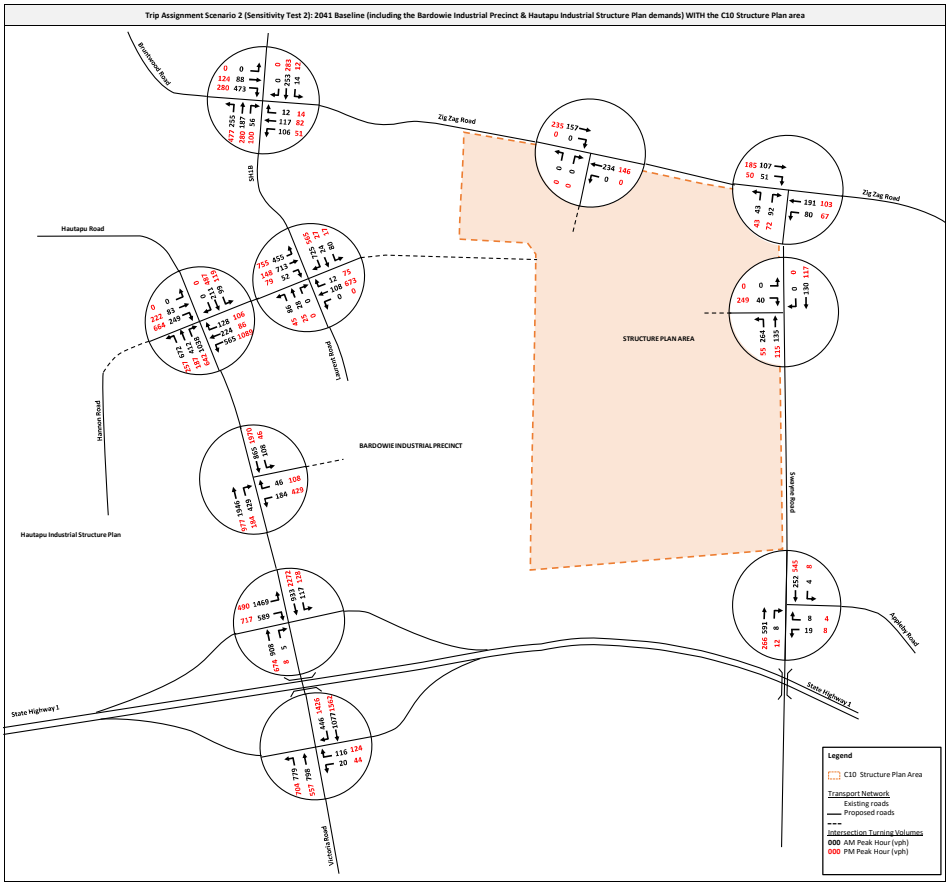
Trip Assignment Scenario 2 (Sensitivity Test 1): 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITHOUT the C10 Structure Plan



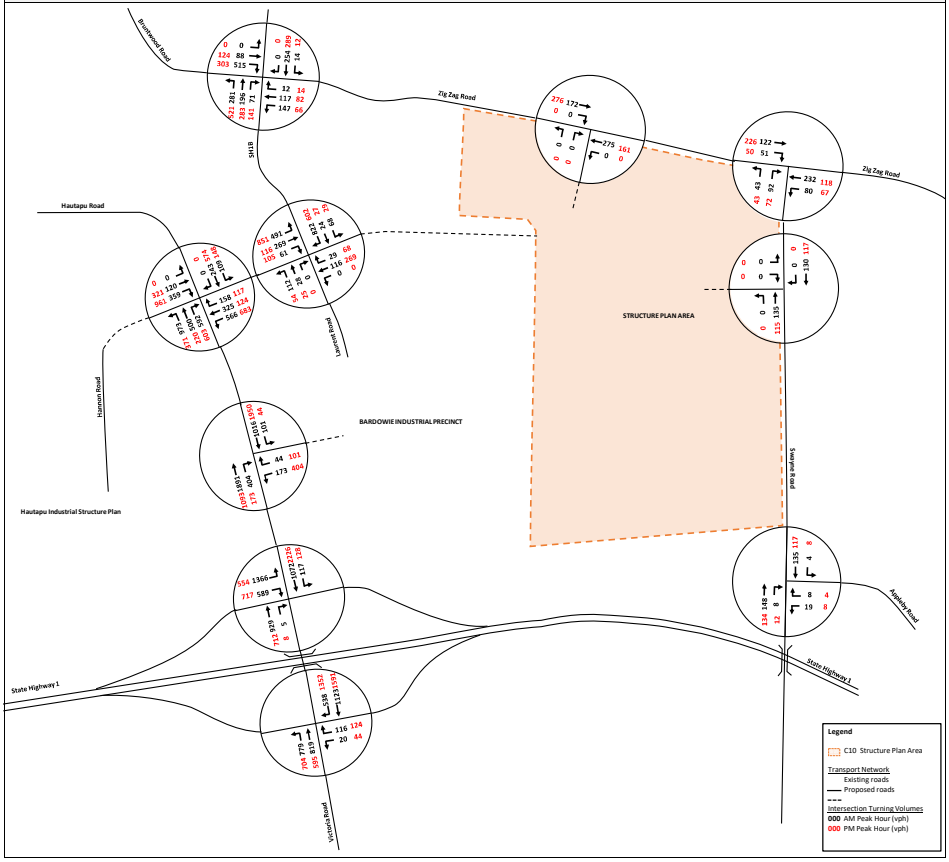
Trip Assignment Scenario 2 (Sensitivity Test 1): 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITH the C10 Structure Plan area



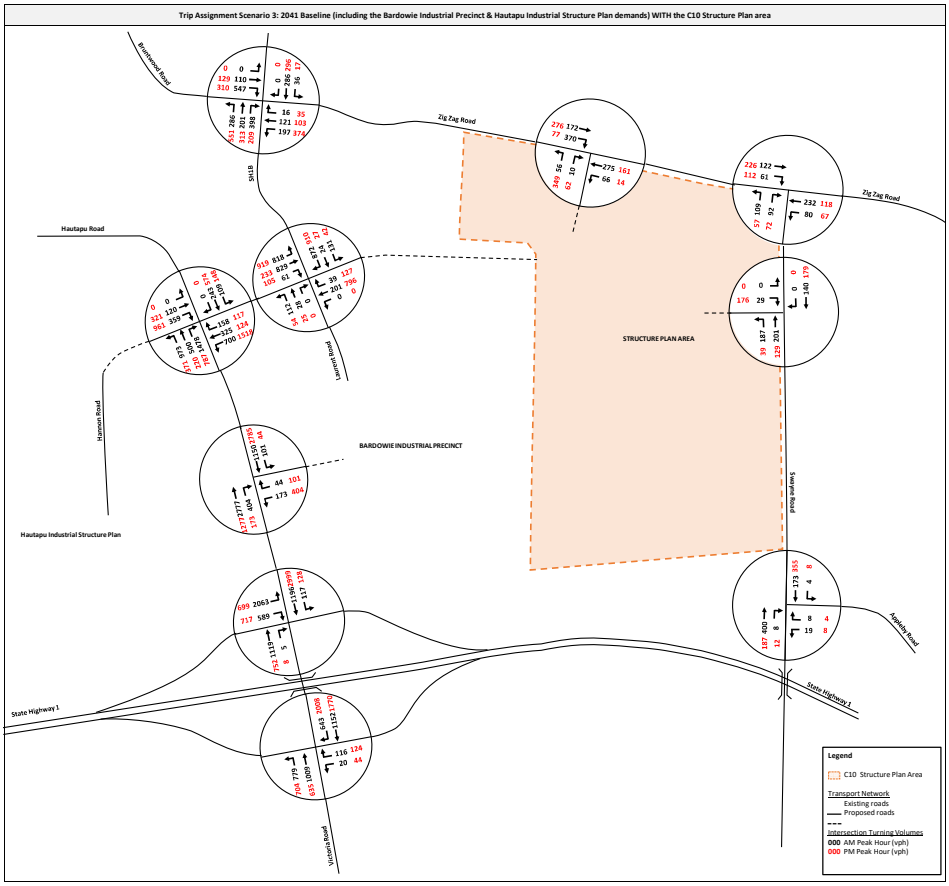




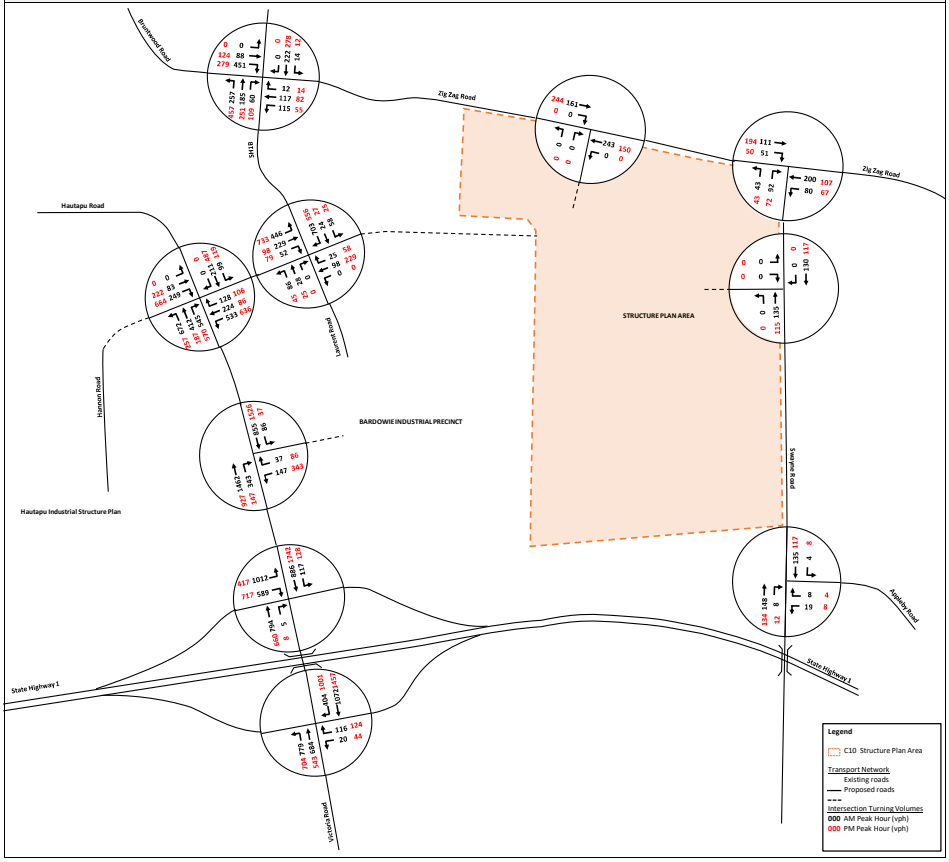
Trip Assignment Scenario 3: 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu industrial Structure Plan demands) WITHOUT the C10 Structure Plan



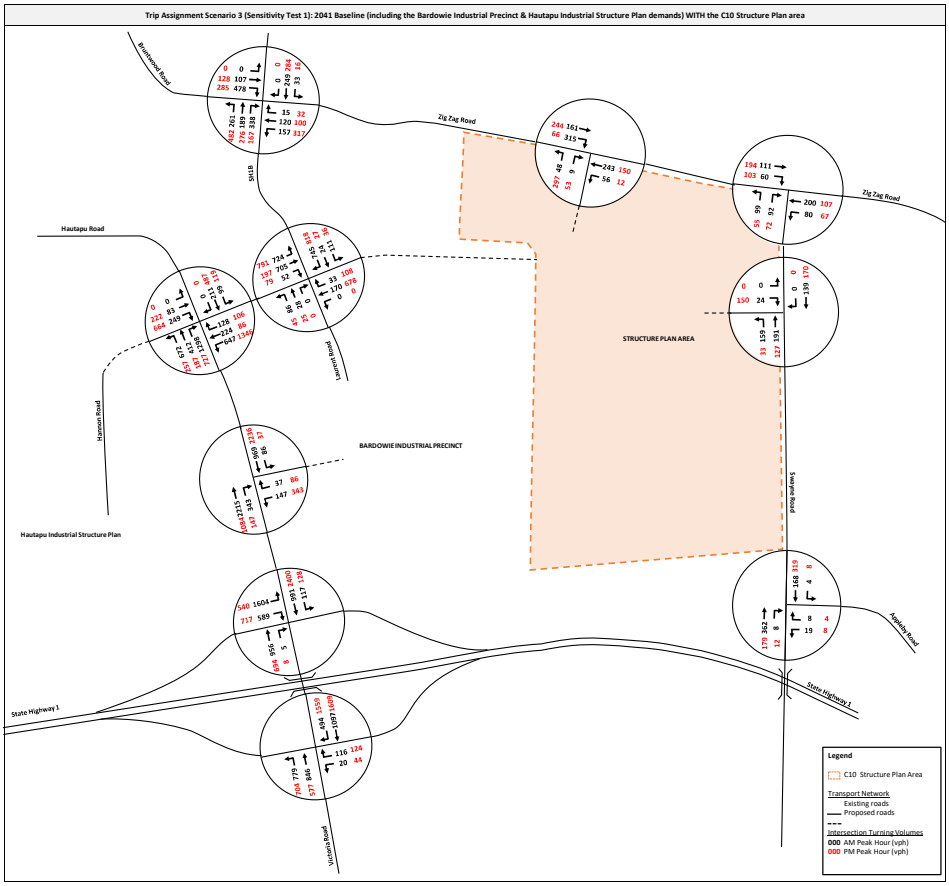
Trip Assignment Scenario 3: 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu industrial Structure Plan demands) WITH the C10 Structure Plan area



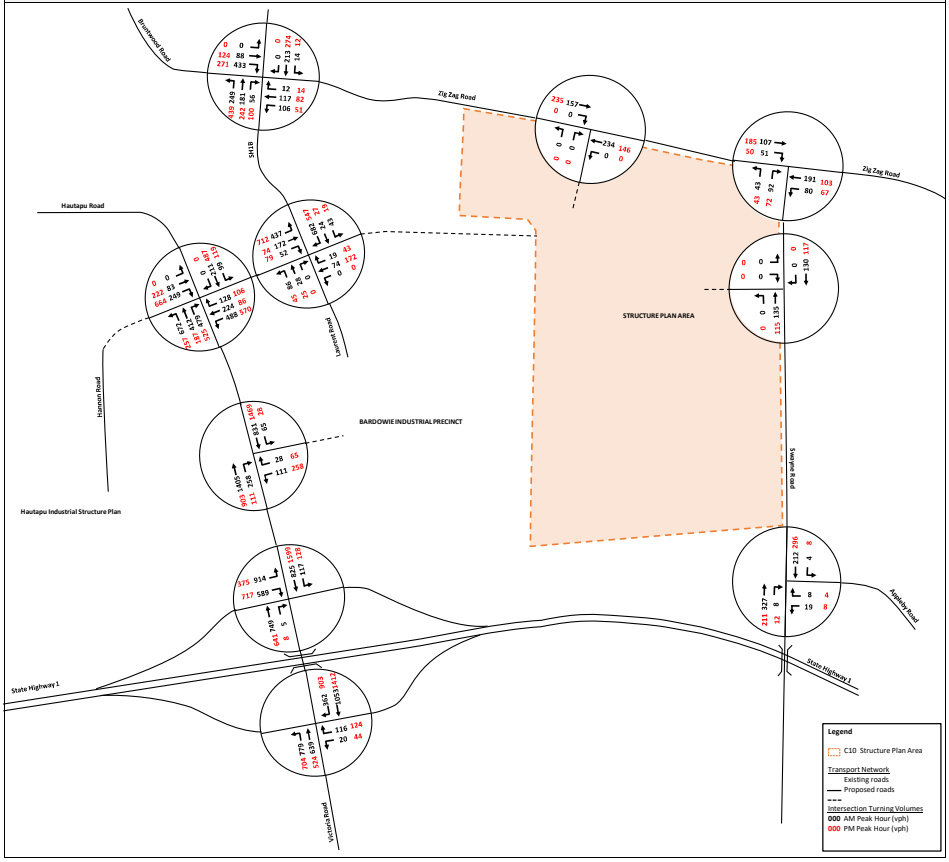
Trip Assignment Scenario 3 (Sensitivity Test 1): 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITHOUT the C10 Structure Plan



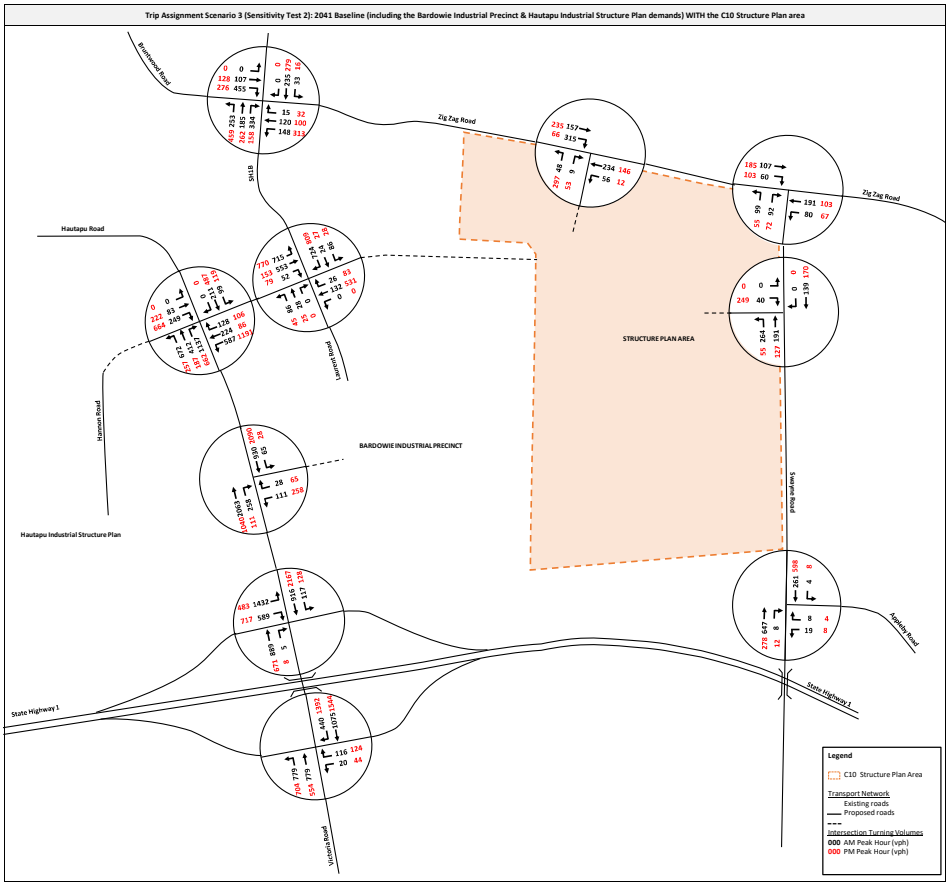
Trip Assignment Scenario 3 (Sensitivity Test 1): 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITH the C10 Structure Plan area



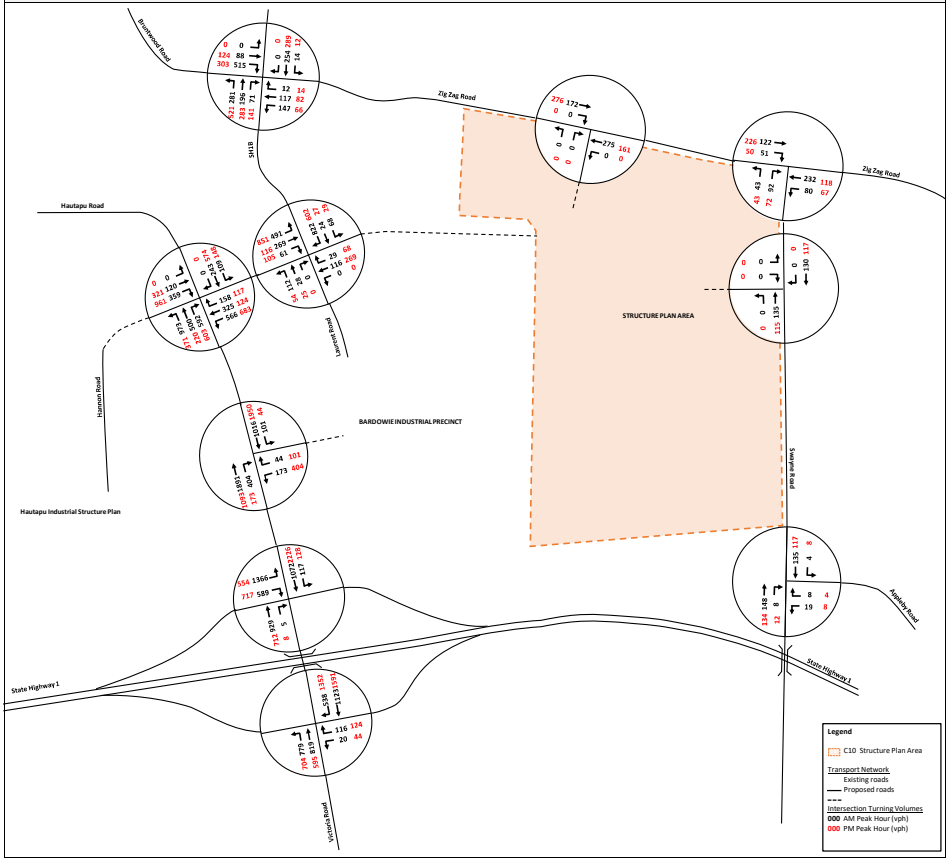
Trip Assignment Scenario 3 (Sensitivity Test 2): 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITHOUT the C10 Structure Plan



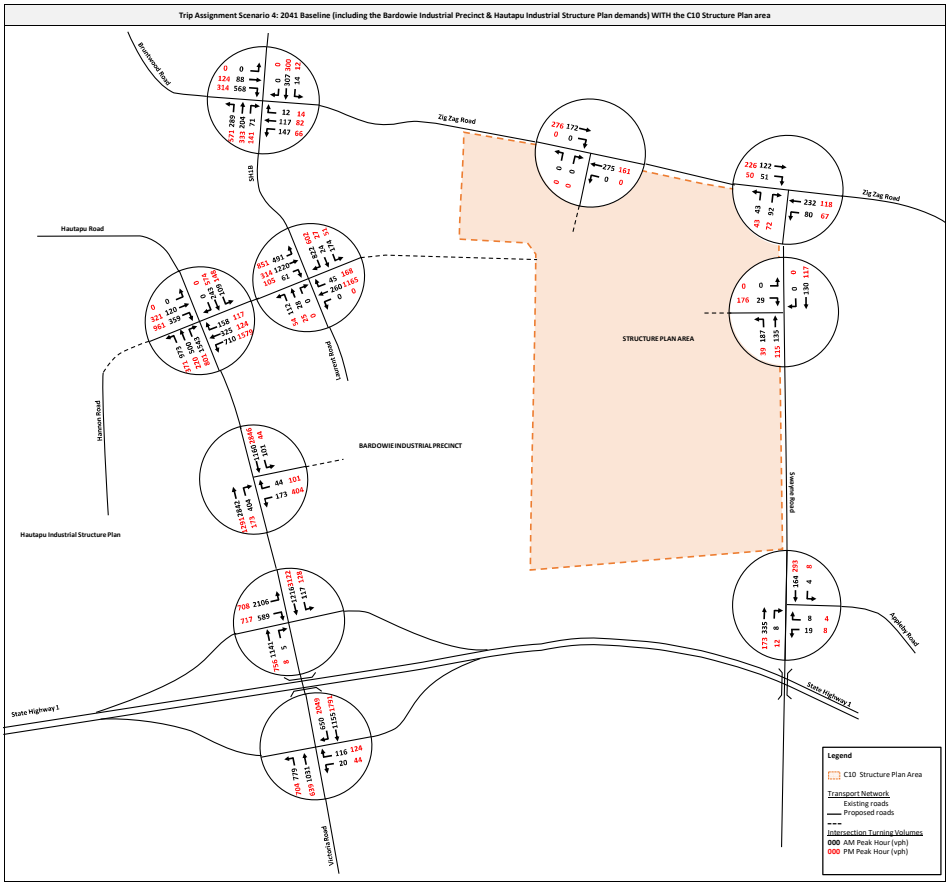
Trip Assignment Scenario 3 (Sensitivity Test 2): 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITH the C10 Structure Plan area



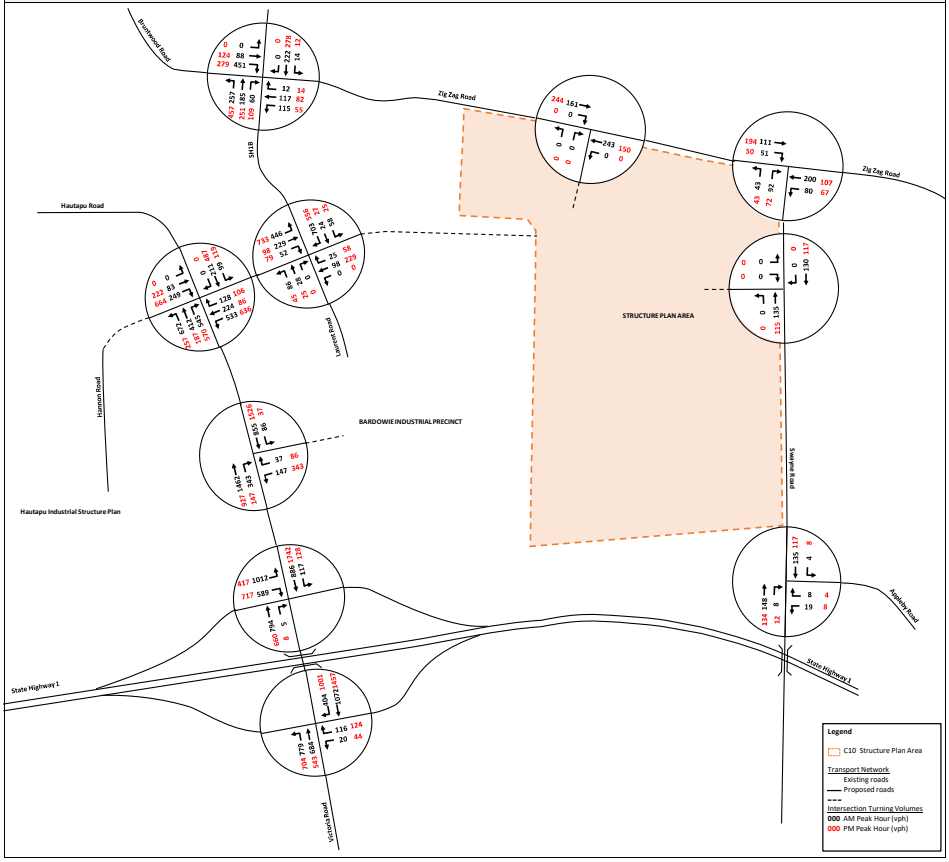
Trip Assignment Scenario 4: 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITHOUT the C10 Structure Plan



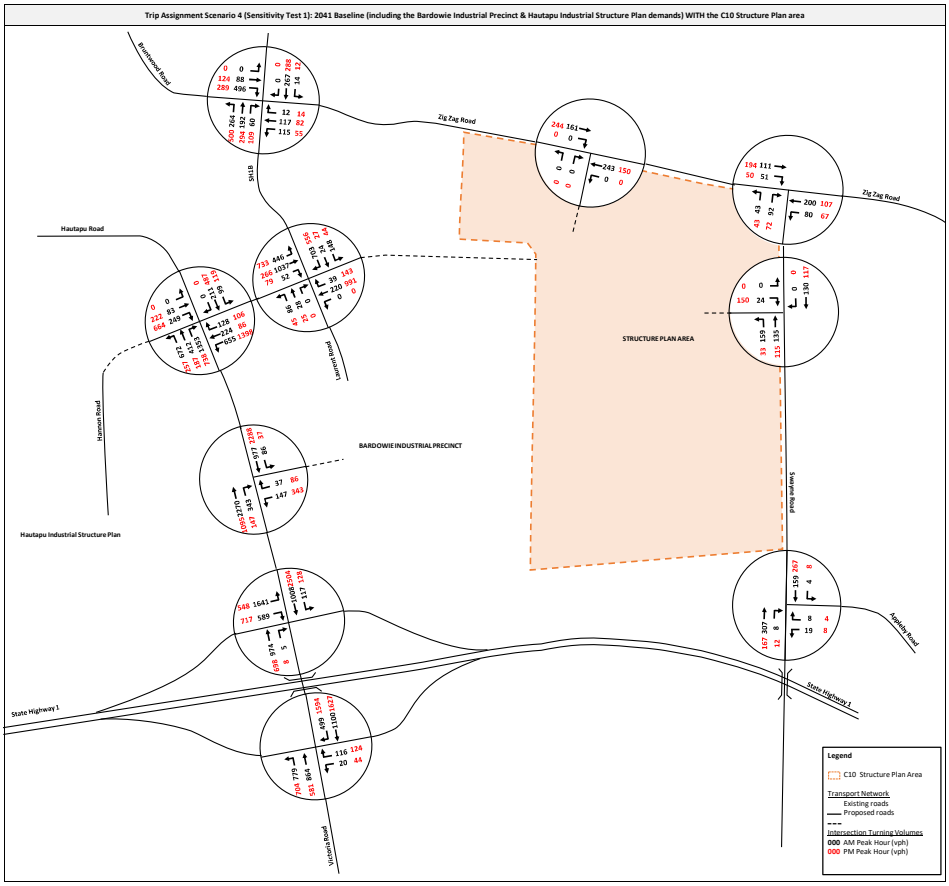
Trip Assignment Scenario 4: 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITH the C10 Structure Plan area



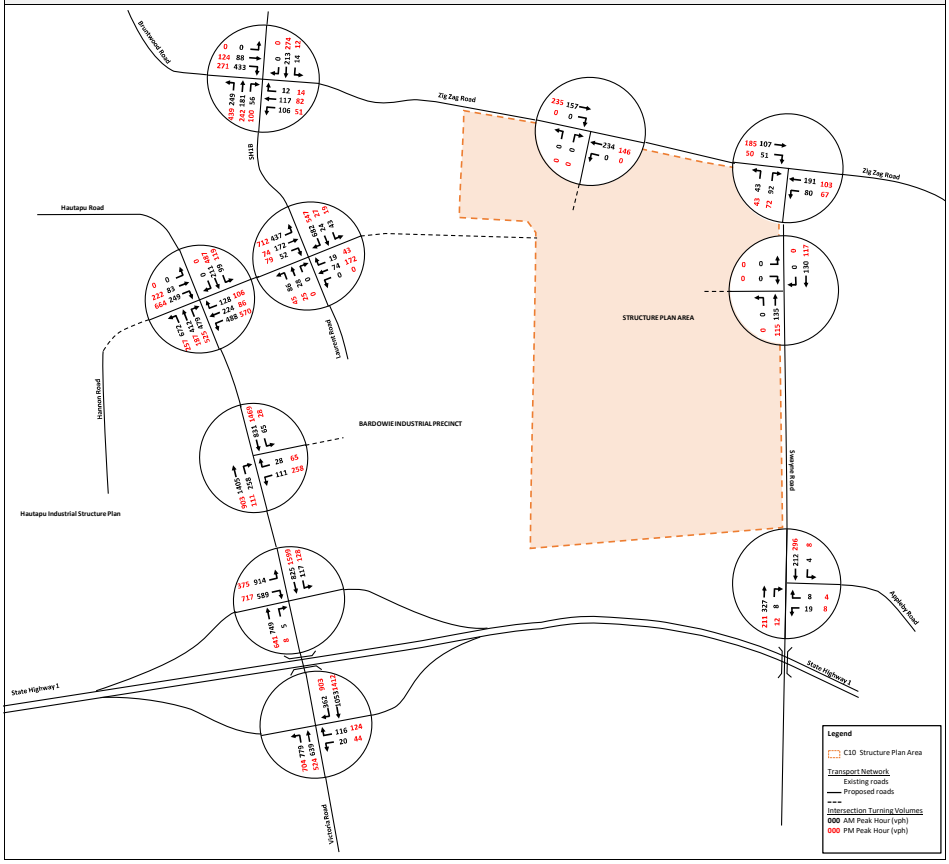
Trip Assignment Scenario 4 (Sensitivity Test 1): 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITHOUT the C10 Structure Plan



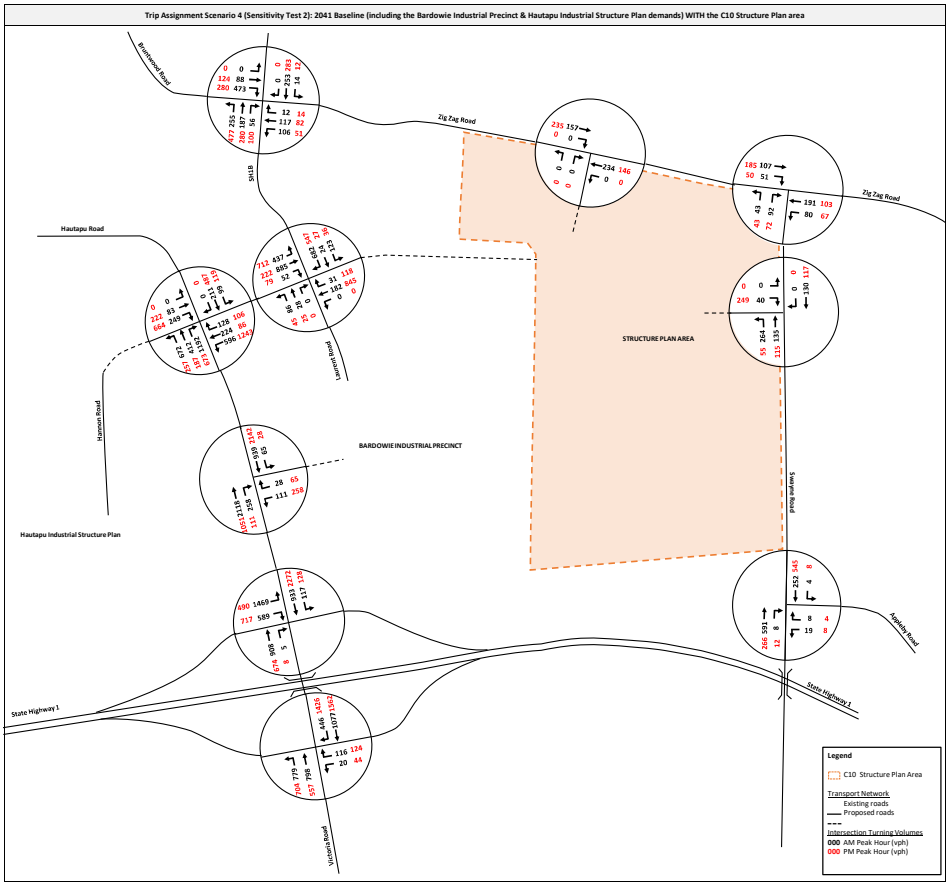
Trip Assignment Scenario 4 (Sensitivity Test 1): 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITH the C10 Structure Plan area



Trip Assignment Scenario 4 (Sensitivity Test 2): 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITHOUT the C10 Structure Plan



Trip Assignment Scenario 4 (Sensitivity Test 2): 2041 Baseline (including the Bardowie Industrial Precinct & Hautapu Industrial Structure Plan demands) WITH the C10 Structure Plan area



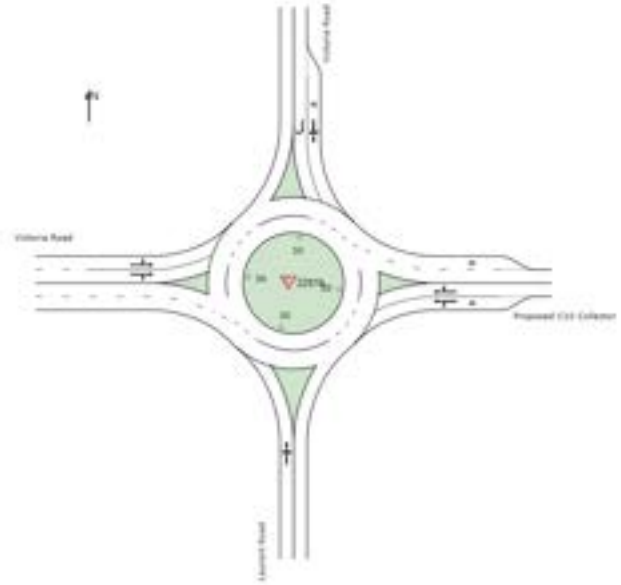
Appendix F Intersection Modelling Results - 2041

1. Victoria Road / E-W Collector Road Intersection

SITE LAYOUT

Site: 2201b [Victoria Rd / Laurent Rd_2041_AM_Dual Lane - Preferred (Site Folder: Scenario 4: HSP (100% dogbone)+BIP (60% south access, 40%dogbone)+C10 (85%dogbone, 15%Swayne))]

New Site
Site Category: Roundabout
Roundabout



LANE SUMMARY

Site: 2201b [Victoria Rd / Laurent Rd_2041_AM_Dual Lane - Preferred (Site Folder: Scenario 4: HSP (100% dogbone)+BIP (60% south access, 40%dogbone)+C10 (85%dogbone, 15%Swayne))]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: Roundabout
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h]	HV [ ] %	Arrival Flows [Total veh/h]	HV [ ] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh.]	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Laurent Road															
Lane 1[^]	121	10.0	121	10.0	828	0.150	100	7.9	LOS A	0.5	8.5	Full	500	0.0	0.0
Approach	121	10.0	121	10.0		0.150		7.9	LOS A	0.5	8.5				
East: Proposed C10 Collector															
Lane 1[^]	124	10.0	124	10.0	836	0.149	100	5.8	LOS A	0.7	5.5	Short	40	0.0	NA
Lane 2	101	10.0	101	10.0	680	0.149	100	8.0	LOS A	0.7	5.1	Full	500	0.0	0.0
Approach	225	10.0	225	10.0		0.149		6.7	LOS A	0.7	5.5				
North: Victoria Road															
Lane 1[^]	465	10.0	465	10.0	842	0.756	100	29.6	LOS C	10.5	79.9	Short	50	0.0	NA
Lane 2	366	10.0	366	10.0	913	0.756	100	32.8	LOS C	9.1	69.2	Full	500	0.0	0.0
Approach	873	10.0	873	10.0		0.756		31.1	LOS C	10.5	79.9				
West: Victoria Road															
Lane 1	460	10.0	460	10.0	1186	0.388	60[^]	3.8	LOS A	2.3	17.4	Full	80	0.0	0.0
Lane 2[^]	986	10.0	986	10.0	1529	0.645	100	3.8	LOS A	5.9	45.2	Full	80	0.0	0.0
Approach	1446	10.0	1446	10.0		0.645		3.8	LOS A	5.9	45.2				
All Vehicles	2665	10.0	2665	10.0		0.756		13.2	LOS B	10.5	79.9				

LANE SUMMARY

Site: 2201b [Victoria Rd / Laurent Rd_2041_PM_Dual Lane - Preferred - Copy (Site Folder: Scenario 4: HSP (100% dogbone)+BIP (60% south access, 40%dogbone)+C10 (85%dogbone, 15%Swayne))]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: Roundabout
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h]	HV [ ] %	Arrival Flows [Total veh/h]	HV [ ] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh.]	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Laurent Road															
Lane 1[^]	75	10.0	75	10.0	500	0.149	100	10.0	LOS B	0.6	4.8	Full	500	0.0	0.0
Approach	75	10.0	75	10.0		0.149		10.0	LOS B	0.6	4.8				
East: Proposed C10 Collector															
Lane 1[^]	554	10.0	554	10.0	980	0.566	100	7.1	LOS A	3.7	28.4	Short	40	0.0	NA
Lane 2	461	10.0	461	10.0	815	0.566	100	9.6	LOS A	3.6	27.2	Full	500	0.0	0.0
Approach	1015	10.0	1015	10.0		0.566		8.2	LOS A	3.7	28.4				
North: Victoria Road															
Lane 1[^]	339	10.0	339	10.0	1149	0.295	100	9.7	LOS A	1.6	12.4	Short	50	0.0	NA
Lane 2	303	10.0	303	10.0	1028	0.295	100	10.9	LOS B	1.6	12.0	Full	500	0.0	0.0
Approach	642	10.0	642	10.0		0.295		10.3	LOS B	1.6	12.4				
West: Victoria Road															
Lane 1[^]	749	10.0	749	10.0	1351	0.555	100	4.1	LOS A	4.4	33.4	Full	80	0.0	0.0
Lane 2	317	10.0	317	10.0	1018	0.312	56[^]	5.6	LOS A	1.7	13.2	Full	80	0.0	0.0
Approach	1066	10.0	1066	10.0		0.555		4.5	LOS A	4.4	33.4				
All Vehicles	2798	10.0	2798	10.0		0.566		7.3	LOS A	4.4	33.4				

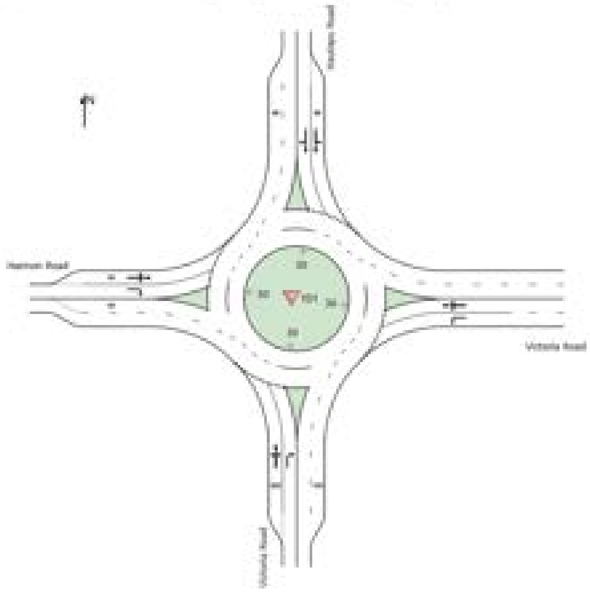
2. Victoria Road / Hautapu Road Intersection

SITE LAYOUT

▽ Site: 101 [Victoria Rd / Hautapu Rd_2041_AM_Dual Lane (2 LT approach lanes from east) (Site Folder: Scenario 4: HSP (100% dogbone)+BIP (60% south access, 40%dogbone)+C10 (85%dogbone, 15%Swayne)]

New Site
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



LANE SUMMARY

▽ Site: 101 [Victoria Rd / Hautapu Rd_2041_AM_Dual Lane (2 LT approach lanes from east) (Site Folder: Scenario 4: HSP (100% dogbone)+BIP (60% south access, 40%dogbone)+C10 (85%dogbone, 15%Swayne)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road															
Lane 1	1283	10.0	1283	10.0	1115	1.151	100	147.9	LOS F	125.8	954.6	Short	200	0.0	NA
Lane 2	1112	10.0	1112	10.0	967	1.151	100	154.1	LOS F	111.0	843.3	Full	500	0.0	29.7
Approach	2396	10.0	2396	10.0		1.151		150.8	LOS F	125.6	954.6				
East: Victoria Road															
Lane 1	408	10.0	408	10.0	883	0.462	83	5.8	LOS A	2.6	20.0	Full	80	0.0	0.0
Lane 2	590	10.0	590	10.0	1060	0.556	100	6.4	LOS A	3.8	29.2	Full	80	0.0	0.0
Approach	998	10.0	998	10.0		0.556		6.1	LOS A	3.8	29.2				
North: Hautapu Road															
Lane 1	137	10.0	137	10.0	359	0.380	98	12.2	LOS B	2.2	16.3	Short	40	0.0	NA
Lane 2	191	10.0	191	10.0	493	0.387	100	10.0	LOS A	2.5	19.1	Full	500	0.0	0.0
Approach	327	10.0	327	10.0		0.387		10.9	LOS B	2.5	19.1				
West: Hamon Road															
Lane 1	205	10.0	205	10.0	410	0.501	100	15.8	LOS B	3.5	26.4	Short	80	0.0	NA
Lane 2	145	10.0	145	10.0	290	0.501	100	20.9	LOS C	2.8	22.4	Full	500	0.0	0.0
Approach	351	10.0	351	10.0		0.501		17.9	LOS B	3.5	26.4				
All Vehicles	4073	10.0	4073	10.0		1.151		92.7	LOS F	125.8	954.6				

LANE SUMMARY

▽ Site: 101 [Victoria Rd / Hautapu Rd_2041_PM_Dual Lane (2 LT approach lanes from east) (Site Folder: Scenario 4: HSP (100% dogbone)+BIP (60% south access, 40%dogbone)+C10 (85%dogbone, 15%Swayne)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road															
Lane 1	621	10.0	621	10.0	1294	0.480	100	4.5	LOS A	3.8	28.5	Short	200	0.0	NA
Lane 2	554	10.0	554	10.0	1155	0.480	100	8.5	LOS A	3.6	27.8	Full	500	0.0	0.0
Approach	1176	10.0	1176	10.0		0.480		6.4	LOS A	3.8	28.5				
East: Victoria Road															
Lane 1	575	10.0	575	10.0	551	1.045	83	829.6	LOS F	32.1	243.8	Full	80	0.0	100.0
Lane 2	935	10.0	935	10.0	745	1.258	100	551.0	LOS F	130.2	989.8	Full	80	0.0	100.0
Approach	1511	10.0	1511	10.0		1.258		857.1	LOS F	130.2	989.8				
North: Hautapu Road															
Lane 1	260	10.0	260	10.0	433	0.601	98	454.8	LOS F	3.7	28.2	Short	40	0.0	NA
Lane 2	379	10.0	379	10.0	620	0.611	100	398.1	LOS F	4.5	34.0	Full	500	0.0	0.0
Approach	639	10.0	639	10.0		0.611		400.8	LOS F	4.5	34.0				
West: Hamon Road															
Lane 1	523	10.0	523	10.0	629	0.831	100	425.3	LOS F	4.7	35.9	Short	80	0.0	NA
Lane 2	411	10.0	411	10.0	651	0.831	100	402.4	LOS F	4.3	32.8	Full	500	0.0	0.0
Approach	934	10.0	934	10.0		0.831		415.3	LOS F	4.7	35.9				
All Vehicles	4259	10.0	4259	10.0		1.258		388.0	LOS F	130.2	989.8				

3. Victoria Road / Zig Zag Road Intersection

SITE LAYOUT

▽ Site: 101v [Victoria Rd / Brushwood Rd / Zig Zag Rd_Single-lane RDT_2041_AM (Site Folder: Scenario 1 & 3 with C10/Fonterra)]

New Site
Site Category: (None)
Roundabout

LANE SUMMARY

▽ Site: 101v [Victoria Rd / Brushwood Rd / Zig Zag Rd_Single-lane RDT_2041_AM (Site Folder: Scenario 1 & 3 with C10/Fonterra)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows (Total veh/h)	HV (%)	Arrival Flows (Total veh/h)	HV (%)	Cap. (veh/h)	Deg. Satn (v/c)	Lane Util. (%)	Aver. Delay (sec)	Level of Service	95% Back Of Queue (Veh.)	(Dist.) (m)	Lane Config	Lane Length (m)	Cap. Adj. (%)	Prob. Block. (%)
South: Victoria Road															
Lane 1[d]	813	10.0	813	10.0	1253	0.678	100	8.5	LOS A	8.2	62.7	Full	300	0.0	0.0
Approach	813	10.0	813	10.0		0.678		8.5	LOS A	8.2	62.7				
East: Zig Zag Road															
Lane 1[d]	298	10.0	298	10.0	581	0.513	100	12.5	LOS B	4.5	34.1	Full	300	0.0	0.0
Approach	298	10.0	298	10.0		0.513		12.5	LOS B	4.5	34.1				
North: Victoria Road															
Lane 1[d]	283	10.0	283	10.0	438	0.650	100	23.8	LOS C	8.9	52.3	Full	300	0.0	0.0
Approach	283	10.0	283	10.0		0.650		23.8	LOS C	8.9	52.3				
West: Brushwood Road															
Lane 1[d]	383	10.0	383	10.0	798	0.839	100	25.3	LOS C	14.5	108.9	Full	300	0.0	0.0
Approach	383	10.0	383	10.0		0.839		25.3	LOS C	14.5	108.9				
All Vehicles	1966	10.0	1966	10.0		0.839		15.0	LOS B	14.5	108.9				

LANE SUMMARY

▽ Site: 101v [Victoria Rd / Brushwood Rd / Zig Zag Rd_Single-lane RDT_2041_PM (Site Folder: Scenario 1 & 3 with C10/Fonterra)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

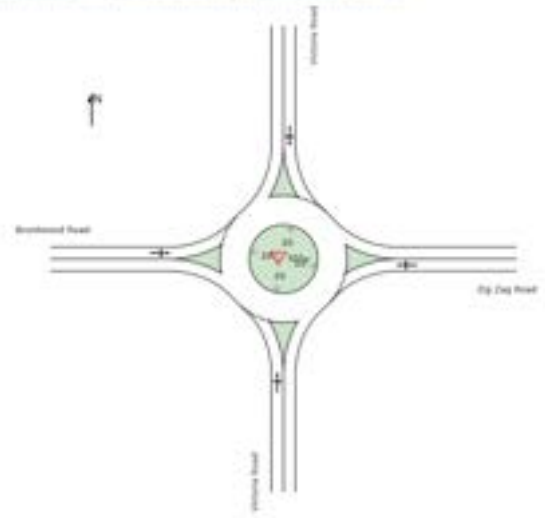
	Demand Flows (Total veh/h)	HV (%)	Arrival Flows (Total veh/h)	HV (%)	Cap. (veh/h)	Deg. Satn (v/c)	Lane Util. (%)	Aver. Delay (sec)	Level of Service	95% Back Of Queue (Veh.)	(Dist.) (m)	Lane Config	Lane Length (m)	Cap. Adj. (%)	Prob. Block. (%)
South: Victoria Road															
Lane 1[d]	925	10.0	925	10.0	1233	0.750	100	5.7	LOS A	10.8	81.8	Full	300	0.0	0.0
Approach	925	10.0	925	10.0		0.750		5.7	LOS A	10.8	81.8				
East: Zig Zag Road															
Lane 1[d]	466	10.0	466	10.0	727	0.644	100	13.2	LOS B	7.0	52.8	Full	300	0.0	0.0
Approach	466	10.0	466	10.0		0.644		13.2	LOS B	7.0	52.8				
North: Victoria Road															
Lane 1[d]	312	10.0	312	10.0	697	0.447	100	8.7	LOS A	3.5	26.5	Full	300	0.0	0.0
Approach	312	10.0	312	10.0		0.447		8.7	LOS A	3.5	26.5				
West: Brushwood Road															
Lane 1[d]	428	10.0	428	10.0	776	0.549	100	11.8	LOS B	5.1	38.7	Full	300	0.0	0.0
Approach	428	10.0	428	10.0		0.549		11.8	LOS B	5.1	38.7				
All Vehicles	2132	10.0	2132	10.0		0.750		8.8	LOS A	10.8	81.8				

4. Victoria Road / Zig Zag Road Intersection + Bourke Property

SITE LAYOUT

Site: 101v [Victoria Rd / Bruntwood Rd / Zig Zag Rd_Single-lane RDT_2041_AM+Bourke (Site Folder: Scenario 1 & 3 with C10/Fonterra)]

New Site
Site Category: (None)
Roundabout



LANE SUMMARY

Site: 101v [Victoria Rd / Bruntwood Rd / Zig Zag Rd_Single-lane RDT_2041_AM+Bourke (Site Folder: Scenario 1 & 3 with C10/Fonterra)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh.	Dist] m	Lane Config.	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road															
Lane 1[^]	927	10.0	927	10.0	1206	0.769	100	7.3	LOS A	11.1	84.6	Full	500	0.0	0.0
Approach	927	10.0	927	10.0		0.769		7.3	LOS A	11.1	84.6				
East: Zig Zag Road															
Lane 1[^]	317	10.0	317	10.0	574	0.552	100	13.6	LOS B	5.1	38.5	Full	500	0.0	0.0
Approach	317	10.0	317	10.0		0.552		13.6	LOS B	5.1	38.5				
North: Victoria Road															
Lane 1[^]	299	10.0	299	10.0	374	0.800	100	44.8	LOS D	10.9	82.9	Full	500	0.0	0.0
Approach	299	10.0	299	10.0		0.800		44.8	LOS D	10.9	82.9				
West: Bruntwood Road															
Lane 1[^]	608	10.0	608	10.0	590	1.032	100	85.1	LOS F	39.6	301.0	Full	500	0.0	0.0
Approach	608	10.0	608	10.0		1.032		85.1	LOS F	39.6	301.0				
All Vehicles	2152	10.0	2152	10.0		1.032		35.4	LOS D	39.6	301.0				

LANE SUMMARY

Site: 101v [Victoria Rd / Bruntwood Rd / Zig Zag Rd_Single-lane RDT_2041_PM+Bourke (Site Folder: Scenario 1 & 3 with C10/Fonterra)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh.	Dist] m	Lane Config.	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road															
Lane 1[^]	965	10.0	965	10.0	1189	0.812	100	7.2	LOS A	14.0	106.4	Full	500	0.0	0.0
Approach	965	10.0	965	10.0		0.812		7.2	LOS A	14.0	106.4				
East: Zig Zag Road															
Lane 1[^]	589	10.0	589	10.0	719	0.820	100	21.3	LOS C	13.4	102.0	Full	500	0.0	0.0
Approach	589	10.0	589	10.0		0.820		21.3	LOS C	13.4	102.0				
North: Victoria Road															
Lane 1[^]	316	10.0	316	10.0	670	0.472	100	9.6	LOS A	3.8	29.2	Full	500	0.0	0.0
Approach	316	10.0	316	10.0		0.472		9.6	LOS A	3.8	29.2				
West: Bruntwood Road															
Lane 1[^]	431	10.0	431	10.0	727	0.593	100	13.2	LOS B	6.0	45.2	Full	500	0.0	0.0
Approach	431	10.0	431	10.0		0.593		13.2	LOS B	6.0	45.2				
All Vehicles	2301	10.0	2301	10.0		0.820		12.3	LOS B	14.0	106.4				

5. Victoria Road / BIL Access

SITE LAYOUT

Site: 101 [Victoria Road/ BIP Collector Road_Dual lane_2041_PM (Site Folder: Scenario 1: HSP (100%dogbone)+BIP (100%south access)+C10 (50%dogdone, 35%Zig, 15%Swayne))]

New Site
Site Category: (None)
Roundabout

LANE SUMMARY

Site: 101 [Victoria Road/ BIP Collector Road_Dual lane_2041_AM (Site Folder: Scenario 1: HSP (100%dogbone)+BIP (100%south access)+C10 (50%dogdone, 35%Zig, 15%Swayne))]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh.	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road															
Lane 1[d]	1305	10.0	1305	10.0	1570	0.831	100	2.7	LOS A	15.6	118.8	Full	500	0.0	0.0
Lane 2	1137	10.0	1137	10.0	1367	0.831	100	5.0	LOS A	14.8	112.8	Full	500	0.0	0.0
Approach	2442	10.0	2442	10.0		0.831		3.8	LOS A	15.6	118.8				
East: BIP Collector Road															
Lane 1[d]	135	10.0	135	10.0	837	0.161	100	4.8	LOS A	0.8	5.7	Full	500	0.0	0.0
Lane 2	107	10.0	107	10.0	667	0.161	100	7.7	LOS A	0.7	5.3	Short	60	0.0	NA
Approach	242	10.0	242	10.0		0.161		6.1	LOS A	0.8	5.7				
North: Victoria Road															
Lane 1[d]	541	10.0	541	10.0	1021	0.530	100	5.2	LOS A	4.1	31.3	Full	500	0.0	0.0
Lane 2	473	10.0	473	10.0	893	0.530	100	5.8	LOS A	4.0	30.5	Full	500	0.0	0.0
Approach	1015	10.0	1015	10.0		0.530		5.5	LOS A	4.1	31.3				
All Vehicles	3699	10.0	3699	10.0		0.831		4.4	LOS A	15.6	118.8				

LANE SUMMARY

Site: 101 [Victoria Road/ BIP Collector Road_Dual lane_2041_PM (Site Folder: Scenario 1: HSP (100%dogbone)+BIP (100%south access)+C10 (50%dogdone, 35%Zig, 15%Swayne))]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh.	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road															
Lane 1[d]	640	10.0	640	10.0	1382	0.463	100	2.6	LOS A	3.7	27.8	Full	500	0.0	0.0
Lane 2	571	10.0	571	10.0	1232	0.463	100	4.6	LOS A	3.5	27.0	Full	500	0.0	0.0
Approach	1211	10.0	1211	10.0		0.463		3.6	LOS A	3.7	27.8				
East: BIP Collector Road															
Lane 1[d]	343	10.0	343	10.0	425	0.806	100	23.6	LOS C	7.1	54.2	Full	500	0.0	0.0
Lane 2	223	10.0	223	10.0	276	0.806	100	32.2	LOS C	5.7	43.1	Short	60	0.0	NA
Approach	565	10.0	565	10.0		0.806		27.0	LOS C	7.1	54.2				
North: Victoria Road															
Lane 1[d]	1099	10.0	1099	10.0	1327	0.829	100	5.4	LOS A	12.2	93.0	Full	500	0.0	0.0
Lane 2	968	10.0	968	10.0	1169	0.829	100	6.3	LOS A	12.5	95.2	Full	500	0.0	0.0
Approach	2067	10.0	2067	10.0		0.829		5.8	LOS A	12.5	95.2				
All Vehicles	3843	10.0	3843	10.0		0.829		8.2	LOS A	12.5	95.2				

6. WEX / Northern Intersection

SITE LAYOUT

LANE SUMMARY

Site: 101 [WEX - Victoria Northern Intersection - Sensitivity #2 Scenario 1 AM With PC - Preferred (Site Folder: WEX - Victoria Northern Intersection)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site Practical Cycle Time)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh.	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road Sth Appr															
Lane 1	468	0.0	468	0.0	696	0.672	100	20.8	LOS C	13.7	96.2	Full	500	0.0	0.0
Lane 2	468	0.0	468	0.0	696	0.672	100	20.8	LOS C	13.7	96.2	Full	500	0.0	0.0
Lane 3	5	0.0	5	0.0	159	0.033	100	37.6	LOS D	0.2	1.2	Short	115	0.0	NA
Approach	941	0.0	941	0.0		0.672		20.9	LOS C	13.7	96.2				
North: Victoria Road Nth Appr															
Lane 1	123	0.0	123	0.0	1394	0.088	100	5.1	LOS A	0.4	2.8	Short	115	0.0	NA
Lane 2	321	0.0	321	0.0	362	0.888	100	40.4	LOS D	13.1	91.9	Full	500	0.0	0.0
Lane 3	321	0.0	321	0.0	362	0.888	100	40.4	LOS D	13.1	91.9	Full	500	0.0	0.0
Lane 4	321	0.0	321	0.0	362	0.888	100	40.4	LOS D	13.1	91.9	Short	200	0.0	NA
Approach	1087	0.0	1087	0.0		0.888		36.4	LOS D	13.1	91.9				
West: Off-Ramp Eastbound															
Lane 1	754	0.0	754	0.0	876	0.861	100	30.1	LOS C	27.6	193.1	Short	200	0.0	NA
Lane 2	754	0.0	754	0.0	876	0.861	100	30.1	LOS C	27.6	193.1	Full	500	0.0	0.0
Lane 3	621	0.0	621	0.0	876	0.709	100	20.6	LOS C	17.1	119.4	Full	500	0.0	0.0
Approach	2128	0.0	2128	0.0		0.861		27.3	LOS C	27.6	193.1				
All Vehicles	4157	0.0	4157	0.0		0.888		29.2	LOS C	27.6	193.1				

LANE SUMMARY

Site: 101 [WEX - Victoria Northern Intersection - Sensitivity #2 Scenario 1 PM With PC - Preferred (Site Folder: WEX - Victoria Northern Intersection)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site Practical Cycle Time)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh.	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road Sth Appr															
Lane 1	337	0.0	337	0.0	851	0.396	100	22.5	LOS C	12.2	85.5	Full	500	0.0	0.0
Lane 2	337	0.0	337	0.0	851	0.396	100	22.5	LOS C	12.2	85.5	Full	500	0.0	0.0
Lane 3	7	0.0	7	0.0	101	0.073	100	60.4	LOS E	0.4	2.8	Short	115	0.0	NA
Approach	682	0.0	682	0.0		0.396		22.9	LOS C	12.2	85.5				
North: Victoria Road Nth Appr															
Lane 1	135	0.0	135	0.0	1502	0.090	100	4.9	LOS A	0.4	3.0	Short	115	0.0	NA
Lane 2	561	0.0	561	0.0	638	0.879	100	46.9	LOS D	32.4	226.7	Full	500	0.0	0.0
Lane 3	561	0.0	561	0.0	638	0.879	100	46.9	LOS D	32.4	226.7	Full	500	0.0	0.0
Lane 4	561	0.0	561	0.0	638	0.879	100	46.9	LOS D	32.4	226.7	Short	200	0.0	NA
Approach	1818	0.0	1818	0.0		0.879		43.6	LOS D	32.4	226.7				
West: Off-Ramp Eastbound															
Lane 1	197	0.0	197	0.0	844	0.234	100	24.0	LOS C	6.4	44.7	Short	200	0.0	NA
Lane 2	197	0.0	197	0.0	844	0.234	100	24.0	LOS C	6.4	44.7	Full	500	0.0	0.0
Lane 3	756	0.0	756	0.0	844	0.895	100	45.1	LOS D	43.3	303.3	Full	500	0.0	0.0
Approach	1151	0.0	1151	0.0		0.895		37.8	LOS D	43.3	303.3				
All Vehicles	3651	0.0	3651	0.0		0.895		38.0	LOS D	43.3	303.3				

7. WEX / Southern Intersection

SITE LAYOUT

LANE SUMMARY

Site: 101 [WEX - Victoria Southern Intersectioin - Sensitivity #2 Scenario 1 AM With PC - Single RT (Site Folder: WEX Victoria Southern Intersection 2041)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site Practical Cycle Time)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road Sth Appr															
Lane 1	820	0.0	820	0.0	1134	0.723	100	14.3	LOS B	14.4	101.0	Short	200	0.0	NA
Lane 2	410	0.0	410	0.0	474	0.866	100	35.9	LOS D	16.1	112.6	Full	500	0.0	0.0
Lane 3	410	0.0	410	0.0	474	0.866	100	35.9	LOS D	16.1	112.6	Full	500	0.0	0.0
Approach	1640	0.0	1640	0.0		0.866		25.1	LOS C	16.1	112.6				
East: Off Ramp Westbound															
Lane 1	21	0.0	21	0.0	697	0.030	100	6.9	LOS A	0.2	1.2	Short	200	0.0	NA
Lane 2	122	0.0	122	0.0	371	0.329	100	31.3	LOS C	3.7	25.9	Full	500	0.0	0.0
Approach	143	0.0	143	0.0		0.329		27.7	LOS C	3.7	25.9				
North: Victoria Road Nth Appr															
Lane 1	566	0.0	566	0.0	1226	0.462	100	7.3	LOS A	10.1	70.5	Full	500	0.0	0.0
Lane 2	566	0.0	566	0.0	1226	0.462	100	7.3	LOS A	10.1	70.5	Full	500	0.0	0.0
Lane 3	463	0.0	463	0.0	557	0.831	100	35.3	LOS D	17.1	119.6	Short	125	0.0	NA
Approach	1595	0.0	1595	0.0		0.831		15.4	LOS B	17.1	119.6				
All Vehicles	3378	0.0	3378	0.0		0.866		20.6	LOS C	17.1	119.6				

LANE SUMMARY

Site: 101 [WEX - Victoria Southern Intersectioin - Sensitivity #2 Scenario 1 PM With PC - Single RT (Site Folder: WEX Victoria Southern Intersection 2041)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road Sth Appr															
Lane 1	741	0.0	741	0.0	530	1.397	100	380.3	LOS F	123.7	865.8	Short	200	0.0	NA
Lane 2	292	0.0	292	0.0	195	1.495	100	526.4	LOS F	54.8	383.7	Full	500	0.0	55.6
Lane 3	292	0.0	292	0.0	195	1.495	100	526.4	LOS F	54.8	383.7	Full	500	0.0	0.0
Approach	1324	0.0	1324	0.0		1.495		444.6	LOS F	123.7	865.8				
East: Off Ramp Westbound															
Lane 1	46	0.0	46	0.0	401	0.115	100	7.6	LOS A	0.7	5.1	Short	70	0.0	NA
Lane 2	131	0.0	131	0.0	210	0.620	100	74.6	LOS E	9.3	65.4	Full	500	0.0	0.0
Approach	177	0.0	177	0.0		0.620		57.0	LOS E	9.3	65.4				
North: Victoria Road Nth Appr															
Lane 1	813	0.0	813	0.0	1573	0.517	100	5.0	LOS A	19.1	134.0	Full	500	0.0	0.0
Lane 2	813	0.0	813	0.0	1573	0.517	100	25.4	LOS C	19.1	134.0	Full	500	0.0	100.0
Lane 3	1465	0.0	1465	0.0	958	1.529	100	536.9	LOS F	282.2	1975.2	Short	125	0.0	NA
Approach	3091	0.0	3091	0.0		1.529		262.5	LOS F	282.2	1975.2				
All Vehicles	4592	0.0	4592	0.0		1.529		367.1	LOS F	282.2	1975.2				

SITE LAYOUT

Site: 101 [WEX - Victoria Southern Intersectioin - Sensitivity #2 Scenario 1 AM With PC - Preferred (Site Folder: WEX Victoria Southern Intersection 2041)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

LANE SUMMARY

Site: 101 [WEX - Victoria Southern Intersectioin - Sensitivity #2 Scenario 1 AM With PC - Preferred (Site Folder: WEX Victoria Southern Intersection 2041)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Practical Cycle Time)

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road Sth Appr															
Lane 1	820	0.0	820	0.0	1185	0.692	100	11.7	LOS B	11.8	82.6	Short	200	0.0	NA
Lane 2	410	0.0	410	0.0	488	0.841	100	29.6	LOS C	13.5	94.7	Full	500	0.0	0.0
Lane 3	410	0.0	410	0.0	488	0.841	100	29.6	LOS C	13.5	94.7	Full	500	0.0	0.0
Approach	1640	0.0	1640	0.0		0.841		20.7	LOS C	13.5	94.7				
East: Off-Ramp Westbound															
Lane 1	21	0.0	21	0.0	717	0.029	100	7.3	LOS A	0.2	1.2	Short	200	0.0	NA
Lane 2	122	0.0	122	0.0	402	0.303	100	26.6	LOS C	3.1	21.8	Full	500	0.0	0.0
Approach	143	0.0	143	0.0		0.303		23.7	LOS C	3.1	21.8				
North: Victoria Road Nth Appr															
Lane 1	566	0.0	566	0.0	1138	0.497	100	7.9	LOS A	9.8	68.4	Full	500	0.0	0.0
Lane 2	566	0.0	566	0.0	1138	0.497	100	7.9	LOS A	9.8	68.4	Full	500	0.0	0.0
Lane 3	77	0.0	77	0.0	433	0.178	20[5]	25.0	LOS C	1.9	13.0	Short	125	0.0	NA
Lane 4	386	0.0	386	0.0	433	0.891	100	39.6	LOS D	14.0	97.8	Short	125	0.0	NA
Approach	1595	0.0	1595	0.0		0.891		16.4	LOS B	14.0	97.8				
All Vehicles	3378	0.0	3378	0.0		0.891		18.8	LOS B	14.0	97.8				

LANE SUMMARY

Site: 101 [WEX - Victoria Southern Intersectioin - Sensitivity #2 Scenario 1 PM With PC - Preferred (Site Folder: WEX Victoria Southern Intersection 2041)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site Practical Cycle Time)

Lane Use and Performance

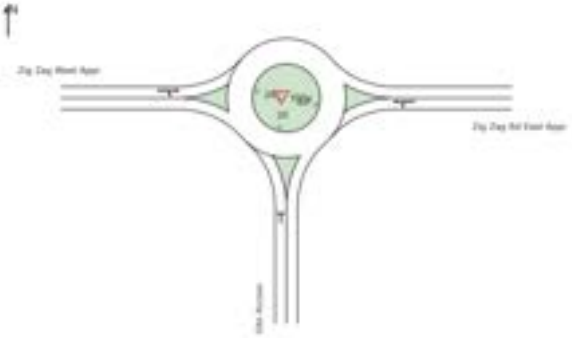
	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road Sth Appr															
Lane 1	741	0.0	741	0.0	882	0.840	100	32.6	LOS C	26.8	187.3	Short	200	0.0	NA
Lane 2	292	0.0	292	0.0	347	0.841	100	45.5	LOS D	14.0	98.0	Full	500	0.0	0.0
Lane 3	292	0.0	292	0.0	347	0.841	100	45.5	LOS D	14.0	98.0	Full	500	0.0	0.0
Approach	1324	0.0	1324	0.0		0.841		38.3	LOS D	26.8	187.3				
East: Off-Ramp Westbound															
Lane 1	46	0.0	46	0.0	501	0.092	100	9.2	LOS A	0.7	4.8	Short	70	0.0	NA
Lane 2	131	0.0	131	0.0	310	0.422	100	41.8	LOS D	5.3	37.1	Full	500	0.0	0.0
Approach	177	0.0	177	0.0		0.422		33.3	LOS C	5.3	37.1				
North: Victoria Road Nth Appr															
Lane 1	813	0.0	813	0.0	1365	0.595	100	7.4	LOS A	18.1	126.9	Full	500	0.0	0.0
Lane 2	813	0.0	813	0.0	1365	0.595	100	7.4	LOS A	18.1	126.9	Full	500	0.0	0.0
Lane 3	733	0.0	733	0.0	846	0.866	100	36.1	LOS D	33.4	233.8	Short	125	0.0	NA
Lane 4	733	0.0	733	0.0	846	0.866	100	36.1	LOS D	33.4	233.8	Short	125	0.0	NA
Approach	3091	0.0	3091	0.0		0.866		21.0	LOS C	33.4	233.8				
All Vehicles	4592	0.0	4592	0.0		0.866		26.5	LOS C	33.4	233.8				

8. Zig Zag Road / Structure Plan Site Access

SITE LAYOUT

▽ Site: 101v [Zig Zag - Site Access 2041 Sensitivity Scenario #1 AM (Site Folder: Zig Zag - Site Access 2041)]

New Site
Site Category: (None)
Roundabout



LANE SUMMARY

▽ Site: 101v [Zig Zag - Site Access 2041 Sensitivity Scenario #1 AM (Site Folder: Zig Zag - Site Access 2041)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Site Access															
Lane 1[^]	60	0.0	60	0.0	1068	0.056	100	4.9	LOS A	0.3	2.4	Full	500	0.0	0.0
Approach	60	0.0	60	0.0		0.056		4.9	LOS A	0.3	2.4				
East: Zig Zag Rd East Appr															
Lane 1[^]	305	0.0	305	0.0	1018	0.300	100	5.2	LOS A	2.0	13.7	Full	500	0.0	0.0
Approach	305	0.0	305	0.0		0.300		5.2	LOS A	2.0	13.7				
West: Zig Zag West Appr															
Lane 1[^]	497	0.0	497	0.0	1663	0.299	100	5.8	LOS A	2.4	16.8	Full	500	0.0	0.0
Approach	497	0.0	497	0.0		0.299		5.8	LOS A	2.4	16.8				
All Vehicles	862	0.0	862	0.0		0.300		5.5	LOS A	2.4	16.8				

LANE SUMMARY

▽ Site: 101v [Zig Zag - Site Access 2041 Sensitivity Scenario #1 PM (Site Folder: Zig Zag - Site Access 2041)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Site Access															
Lane 1[^]	368	0.0	368	0.0	1234	0.298	100	4.5	LOS A	2.1	14.5	Full	500	0.0	0.0
Approach	368	0.0	368	0.0		0.298		4.5	LOS A	2.1	14.5				
East: Zig Zag Rd East Appr															
Lane 1[^]	166	0.0	166	0.0	1339	0.124	100	3.1	LOS A	0.7	5.2	Full	500	0.0	0.0
Approach	166	0.0	166	0.0		0.124		3.1	LOS A	0.7	5.2				
West: Zig Zag West Appr															
Lane 1[^]	317	0.0	317	0.0	1420	0.223	100	4.1	LOS A	1.8	10.9	Full	500	0.0	0.0
Approach	317	0.0	317	0.0		0.223		4.1	LOS A	1.8	10.9				
All Vehicles	852	0.0	852	0.0		0.298		4.1	LOS A	2.1	14.5				

Appendix G Zig Zag – Site Access Intersection with an Additional 15ha Development (22ha in total) South of the Mangaone Stream

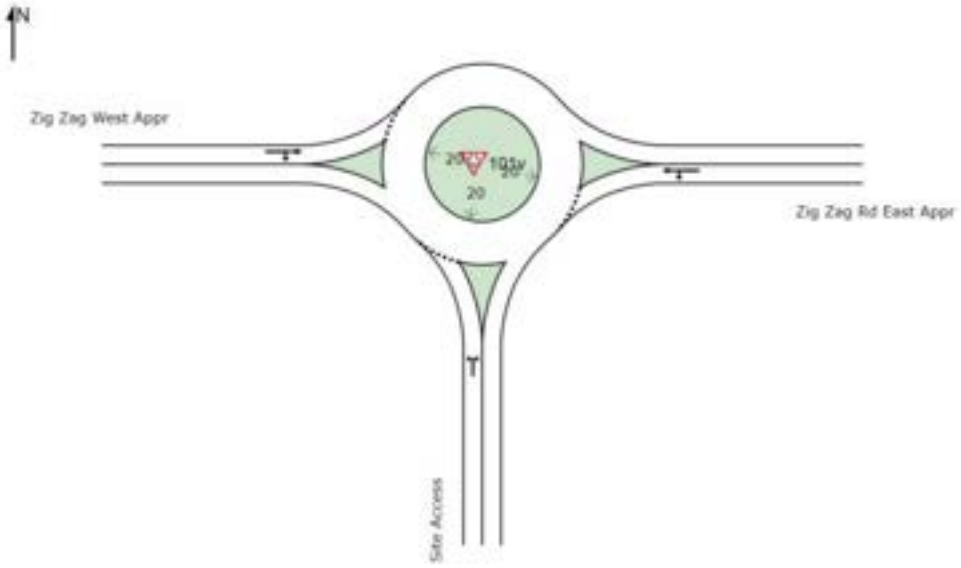
1. Zig Zag - Site Access Intersection with an Additional 15ha Development (22ha in total) South of the Mangaone Stream

SITE LAYOUT

Site: 101v [Zig Zag - Site Access 2041 Sensitivity Scenario #1 PM +15ha (Site Folder: Zig Zag - Site Access 2041)]

New Site
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



LANE SUMMARY

Site: 101v [Zig Zag - Site Access 2041 Sensitivity Scenario #1 AM +15ha (Site Folder: Zig Zag - Site Access 2041)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh.	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Site Access															
Lane 1	102	0.0	102	0.0	1052	0.097	100	4.9	LOS A	0.6	4.3	Full	500	0.0	0.0
Approach	102	0.0	102	0.0		0.097		4.9	LOS A	0.6	4.3				
East: Zig Zag Rd East Appr															
Lane 1	348	0.0	348	0.0	837	0.416	100	7.4	LOS A	2.9	20.5	Full	500	0.0	0.0
Approach	348	0.0	348	0.0		0.416		7.4	LOS A	2.9	20.5				
West: Zig Zag West Appr															
Lane 1	728	0.0	728	0.0	1643	0.443	100	6.3	LOS A	4.3	30.2	Full	500	0.0	0.0
Approach	728	0.0	728	0.0		0.443		6.3	LOS A	4.3	30.2				
All Vehicles	1179	0.0	1179	0.0		0.443		6.5	LOS A	4.3	30.2				

LANE SUMMARY

Site: 101v [Zig Zag - Site Access 2041 Sensitivity Scenario #1 PM +15ha (Site Folder: Zig Zag - Site Access 2041)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

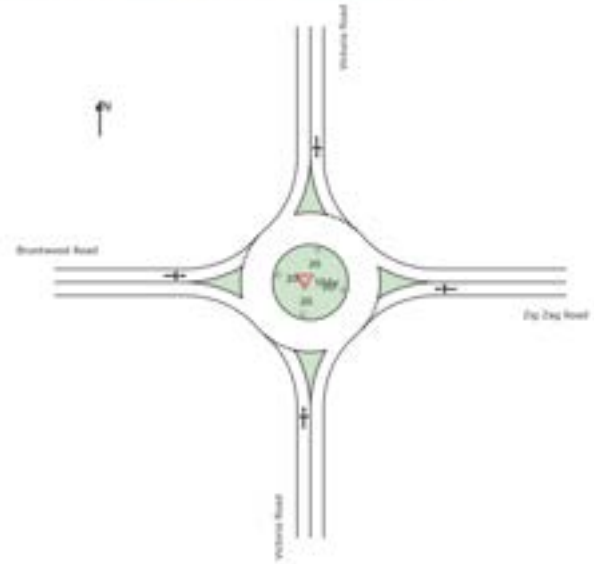
	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh.	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Site Access															
Lane 1	626	0.0	626	0.0	1268	0.494	100	4.8	LOS A	4.3	30.4	Full	500	0.0	0.0
Approach	626	0.0	626	0.0		0.494		4.8	LOS A	4.3	30.4				
East: Zig Zag Rd East Appr															
Lane 1	175	0.0	175	0.0	1241	0.141	100	3.5	LOS A	0.9	6.1	Full	500	0.0	0.0
Approach	175	0.0	175	0.0		0.141		3.5	LOS A	0.9	6.1				
West: Zig Zag West Appr															
Lane 1	365	0.0	365	0.0	1335	0.274	100	4.8	LOS A	2.0	14.1	Full	500	0.0	0.0
Approach	365	0.0	365	0.0		0.274		4.8	LOS A	2.0	14.1				
All Vehicles	1166	0.0	1166	0.0		0.494		4.6	LOS A	4.3	30.4				

1. Zig Zag – Victoria - Bruntwood Intersection with an Additional 15ha Development (22ha in total) South of the Mangaone Stream

SITE LAYOUT

▽ Site: 101v [Victoria Rd / Bruntwood Rd / Zig Zag Rd_Single-lane RDT_2041_PM +15ha (Site Folder: Scenario 2 & 4 with C10/Fonterra)]

New Site
Site Category: (None)
Roundabout



LANE SUMMARY

▽ Site: 101v [Victoria Rd / Bruntwood Rd / Zig Zag Rd_Single-lane RDT_2041_AM +15ha (Site Folder: Scenario 2 & 4 with C10/Fonterra)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h]	HV [ ] %	Arrival Flows [Total veh/h]	HV [ ] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh.]	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road															
Lane 1[d]	606	10.0	606	10.0	1156	0.524	100	5.4	LOS A	5.1	36.5	Full	500	0.0	0.0
Approach	606	10.0	606	10.0		0.524		5.4	LOS A	5.1	36.5				
East: Zig Zag Road															
Lane 1[d]	283	10.0	283	10.0	556	0.510	100	13.2	LOS B	4.4	33.7	Full	500	0.0	0.0
Approach	283	10.0	283	10.0		0.510		13.2	LOS B	4.4	33.7				
North: Victoria Road															
Lane 1[d]	304	10.0	304	10.0	452	0.673	100	21.8	LOS C	7.3	55.7	Full	500	0.0	0.0
Approach	304	10.0	304	10.0		0.673		21.8	LOS C	7.3	55.7				
West: Bruntwood Road															
Lane 1[d]	720	10.0	720	10.0	926	0.778	100	15.0	LOS B	12.0	91.8	Full	500	0.0	0.0
Approach	720	10.0	720	10.0		0.778		15.0	LOS B	12.0	91.8				
All Vehicles	1914	10.0	1914	10.0		0.778		12.7	LOS B	12.0	91.8				

LANE SUMMARY

▽ Site: 101v [Victoria Rd / Bruntwood Rd / Zig Zag Rd_Single-lane RDT_2041_PM +15ha (Site Folder: Scenario 2 & 4 with C10/Fonterra)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

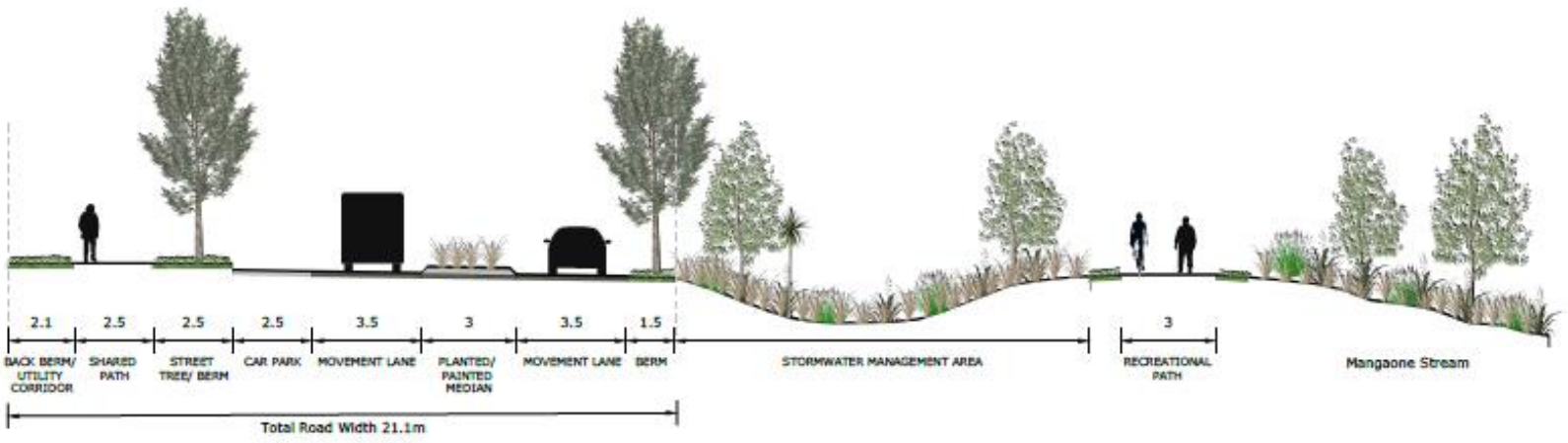
	Demand Flows [Total veh/h]	HV [ ] %	Arrival Flows [Total veh/h]	HV [ ] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh.]	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Victoria Road															
Lane 1[d]	920	10.0	920	10.0	1306	0.705	100	4.8	LOS A	9.5	72.0	Full	500	0.0	0.0
Approach	920	10.0	920	10.0		0.705		4.8	LOS A	9.5	72.0				
East: Zig Zag Road															
Lane 1[d]	155	10.0	155	10.0	722	0.214	100	7.9	LOS A	1.4	10.3	Full	500	0.0	0.0
Approach	155	10.0	155	10.0		0.214		7.9	LOS A	1.4	10.3				
North: Victoria Road															
Lane 1[d]	314	10.0	314	10.0	710	0.442	100	8.4	LOS A	3.4	25.9	Full	500	0.0	0.0
Approach	314	10.0	314	10.0		0.442		8.4	LOS A	3.4	25.9				
West: Bruntwood Road															
Lane 1[d]	448	10.0	448	10.0	827	0.542	100	11.0	LOS B	4.9	37.0	Full	500	0.0	0.0
Approach	448	10.0	448	10.0		0.542		11.0	LOS B	4.9	37.0				
All Vehicles	1837	10.0	1837	10.0		0.705		7.2	LOS A	9.5	72.0				

Appendix H Plan Change Transport Infrastructure – Long Term Transport Network Form

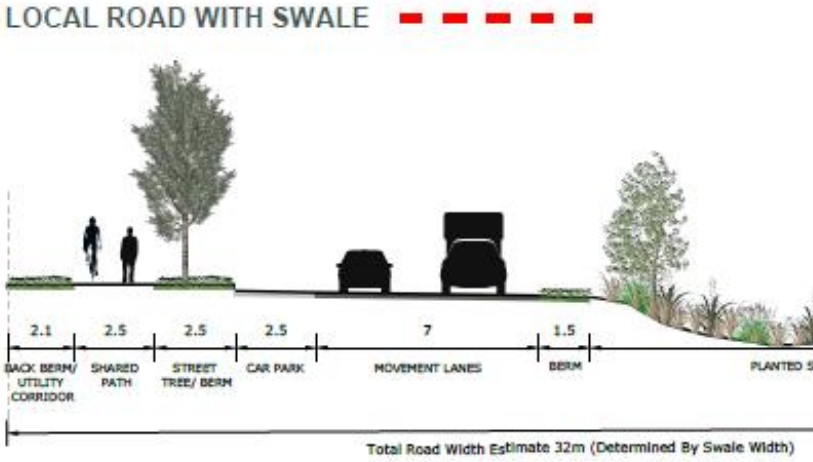
Appendix I Indicative Cross Section Forms

INDICATIVE ROAD CROSS SECTIONS

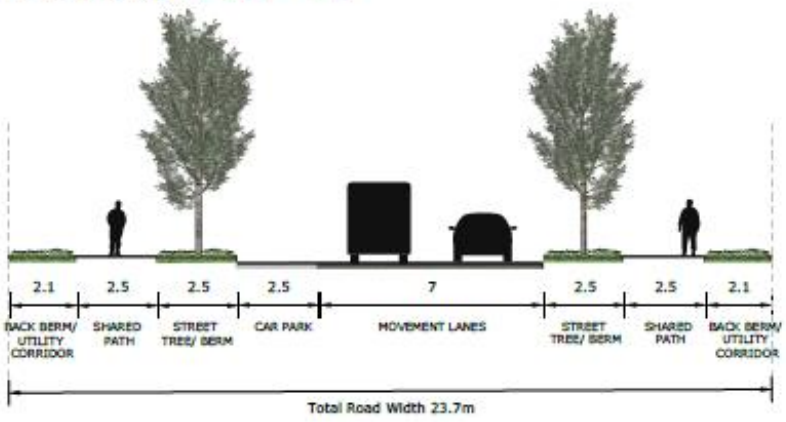
COLLECTOR ROAD



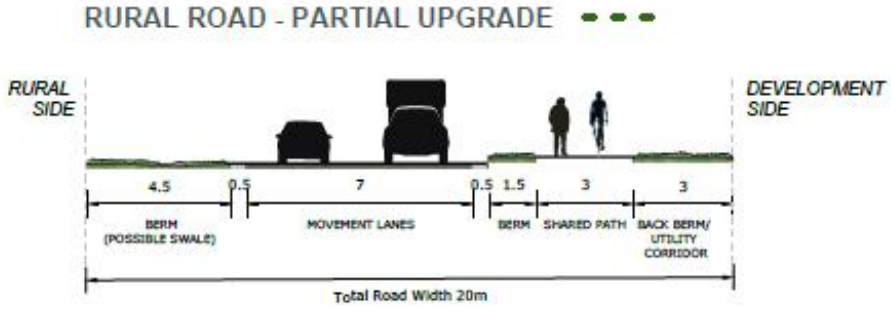
LOCAL ROAD WITH SWALE



LOCAL ROAD

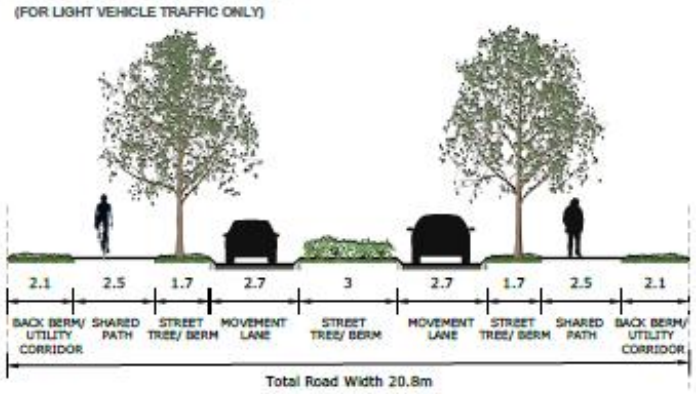


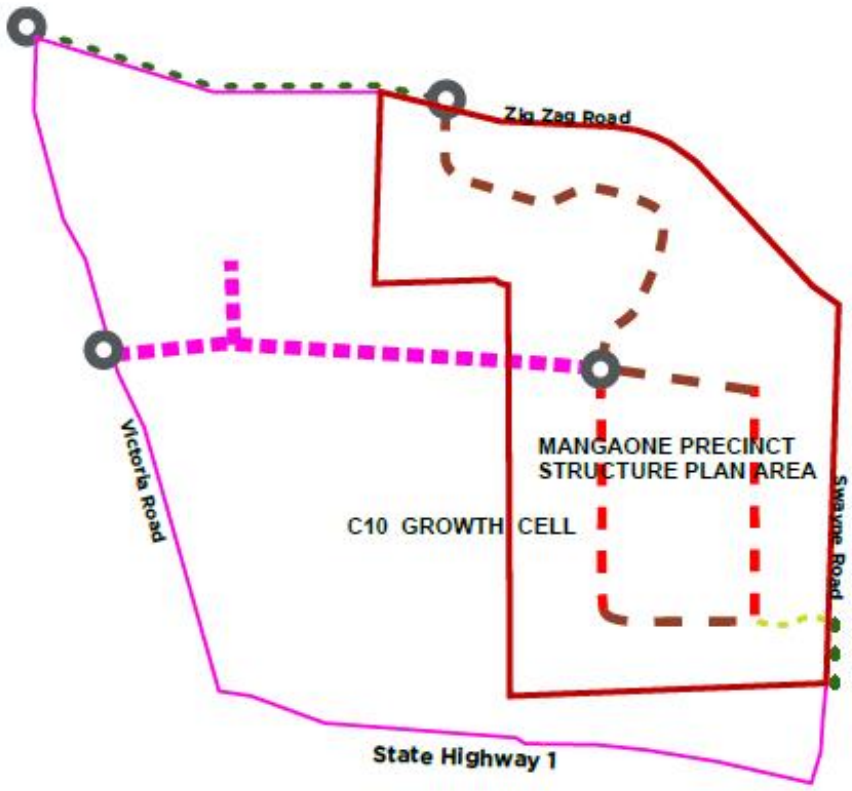
RURAL ROAD - PARTIAL UPGRADE



MINOR ACCESSWAY

(FOR LIGHT VEHICLE TRAFFIC ONLY)





Appendix J Pedestrian and Bicycle Path Assessments

Summary Evaluation Pedestrian and Cycle Facilities

Austroads Guide to Road Design Part 6A: S5.1.3 Bicycle Paths

Shared Path Network Location & Description	Cross Section Path		Scenario 1 PM Peak Vehicle Demands	Cycle Mode Share %	Pedestrian Mode Share %	Peak Hour Movement Demand (Two-Way Total)		Path Movement Demands (Two-Way Total) - 50/50 Split				Austroads Path Width		Compliance	Path Movement Demands (Two-Way Total) - 75/25 Split				Austroads Path Width Requirement (m) -		Compliance
								Side 1		Side 2					Side 1		Side 2				
	Side 1	Side 2				Cycles	Pedestrians	Cycles	Pedestrians	Cycles	Pedestrians	Side 1	Side 2		Cycles	Pedestrians	Cycles	Pedestrians	Side 1	Side 2	
Internal Urban Industrial Collector Road	3	2.5	487	7.5%	2.5%	37	12	18	6	18	6	2.5	2.5	Yes	27	9	9	3	2.5	2.5	Yes
Internal Industrial Local Road with Swale	2.5	2.5	320	7.5%	2.5%	24	8	12	4	12	4	2.5	2.5	Yes	18	6	6	2	2.5	2.5	Yes
Internal Urban Industrial Local Road	2.5	2.5	160	7.5%	2.5%	12	4	6	2	6	2	2.5	2.5	Yes	9	3	3	1	2.5	2.5	Yes
Minor Accessway Link to Swayne Road	2.5	2.5	304	7.5%	2.5%	23	8	11	4	11	4	2.5	2.5	Yes	17	6	6	2	2.5	2.5	Yes
Zig Zag Road	3	N/A	744	7.5%	2.5%	56	19	56	19	N/A	N/A	2.5	2.5	Yes	56	19	N/A	N/A	2.5	2.5	Yes
Swayne Road	3	N/A	900	7.5%	2.5%	68	23	68	23	N/A	N/A	2.5	2.5	Yes	68	23	N/A	N/A	2.5	2.5	Yes
Victoria Road - WEX to BIL Roundabout	3	N/A	3449	7.5%	2.5%	259	86	129	43	129	43	2.5	2.5	Yes	194	65	65	22	3.0	2.5	Yes
Victoria Road - BIL Roundabout to Hautapu	3	N/A	3038	7.5%	2.5%	228	76	114	38	114	38	2.5	2.5	Yes	171	57	57	19	3.0	2.5	Yes
Victoria Road - Hautapu to Mangaone Precinct Collector	3	N/A	2201	7.5%	2.5%	165	55	83	28	83	28	2.5	2.5	Yes	124	41	41	14	2.5	2.5	Yes

Shared Path Network Location & Description	Cross Section Path		Scenario 1 PM Peak Vehicle Demands	Cycle Mode Share %	Pedestrian Mode Share %	Peak Hour Movement Demand (Two-Way Total)		Path Movement Demands (Two-Way Total) - 50/50 Split				Austroads Path Width		Compliance	Path Movement Demands (Two-Way Total) - 75/25 Split				Austroads Path Width Requirement (m) -		Compliance
								Side 1		Side 2					Side 1		Side 2				
	Side 1	Side 2				Cycles	Pedestrians	Cycles	Pedestrians	Cycles	Pedestrians	Side 1	Side 2		Cycles	Pedestrians	Cycles	Pedestrians	Side 1	Side 2	
Internal Urban Industrial Collector Road	3	2.5	487	10%	5%	49	24	24	12	24	12	2.5	2.5	Yes	37	18	12	6	2.5	2.5	Yes
Internal Industrial Local Road with Swale	2.5	2.5	320	10%	5%	32	16	16	8	16	8	2.5	2.5	Yes	24	12	8	4	2.5	2.5	Yes
Internal Urban Industrial Local Road	2.5	2.5	160	10%	5%	16	8	8	4	8	4	2.5	2.5	Yes	12	6	4	2	2.5	2.5	Yes
Minor Accessway Link to Swayne Road	2.5	2.5	304	10%	5%	30	15	15	8	15	8	2.5	2.5	Yes	23	11	8	4	2.5	2.5	Yes
Zig Zag Road	3	N/A	744	10%	5%	74	37	74	37	N/A	N/A	2.5	N/A	Yes	74	37	N/A	N/A	2.5	N/A	Yes
Swayne Road	3	N/A	900	10%	5%	90	45	90	45	N/A	N/A	2.5	N/A	Yes	90	45	N/A	N/A	2.5	N/A	Yes
Victoria Road - WEX to BIL Roundabout	3	N/A	3449	10%	5%	345	172	172	86	172	86	3	3	Yes	259	129	86	43	2.5B+1.5P	2.5	Note
Victoria Road - BIL Roundabout to Hautapu	3	N/A	3038	10%	5%	304	152	152	76	152	76	3	3	Yes	228	114	76	38	2.5B+1.5P	2.5	Note
Victoria Road - Hautapu to Mangaone Precinct Collector	3	N/A	2201	10%	5%	220	110	110	55	110	55	3	3	Yes	165	83	55	28	3.0	2.5	Yes

Figure 5.4: Path widths for a 50/50 directional split

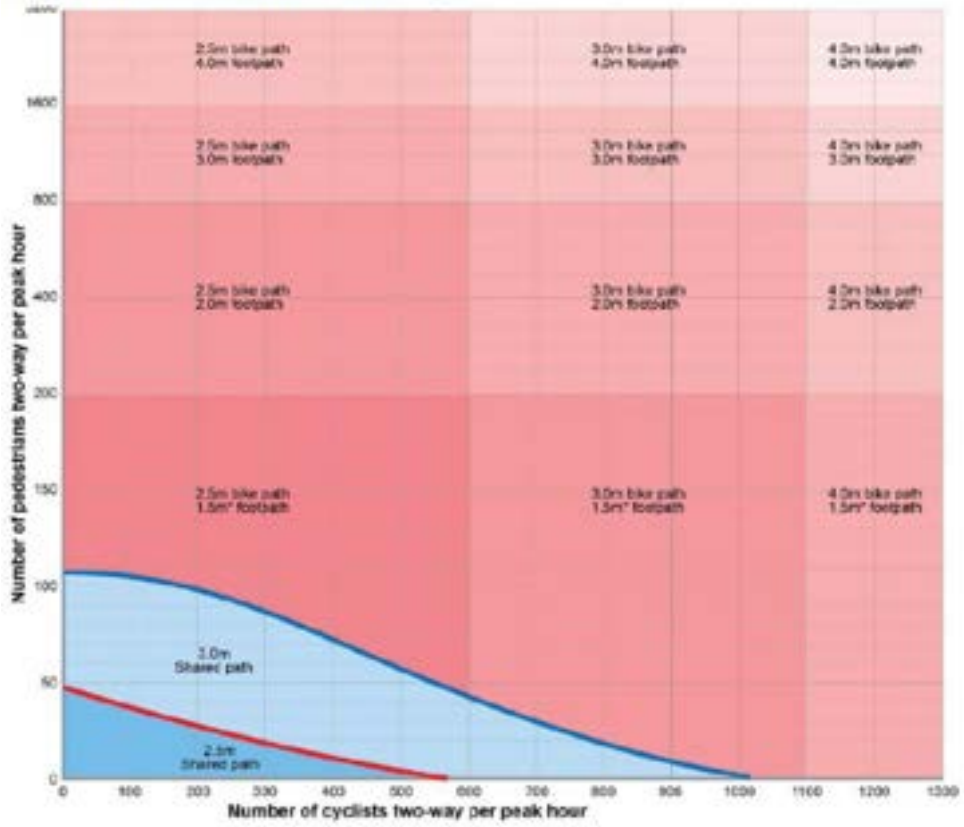
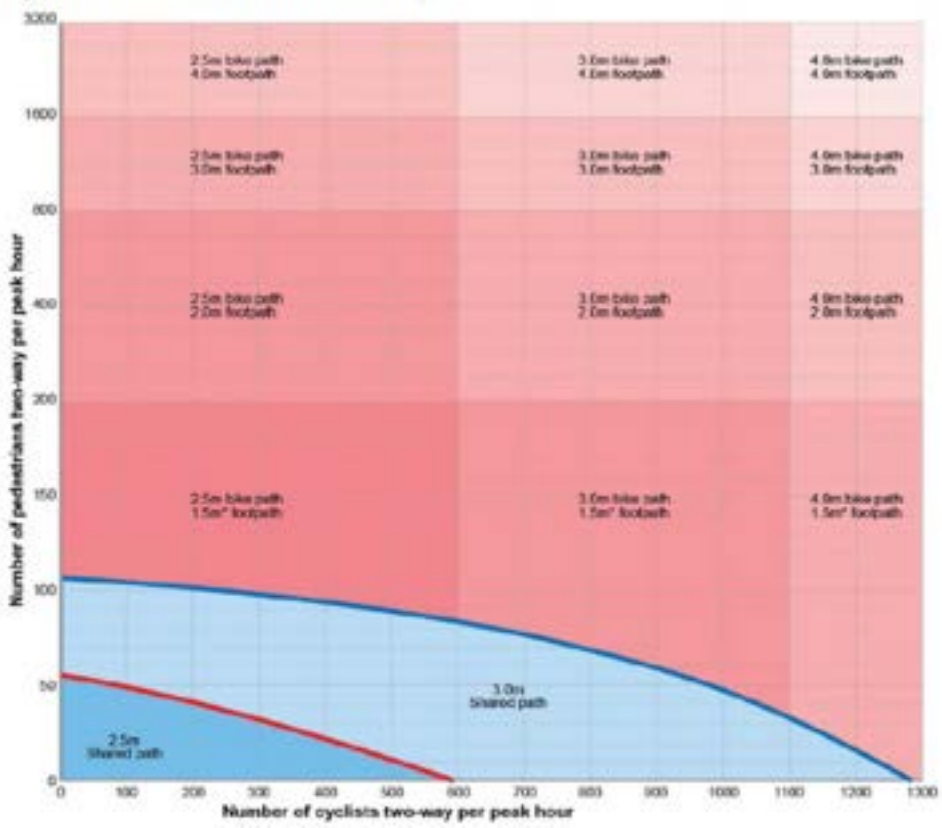


Figure 5.5: Path widths for a 75/25 directional split



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